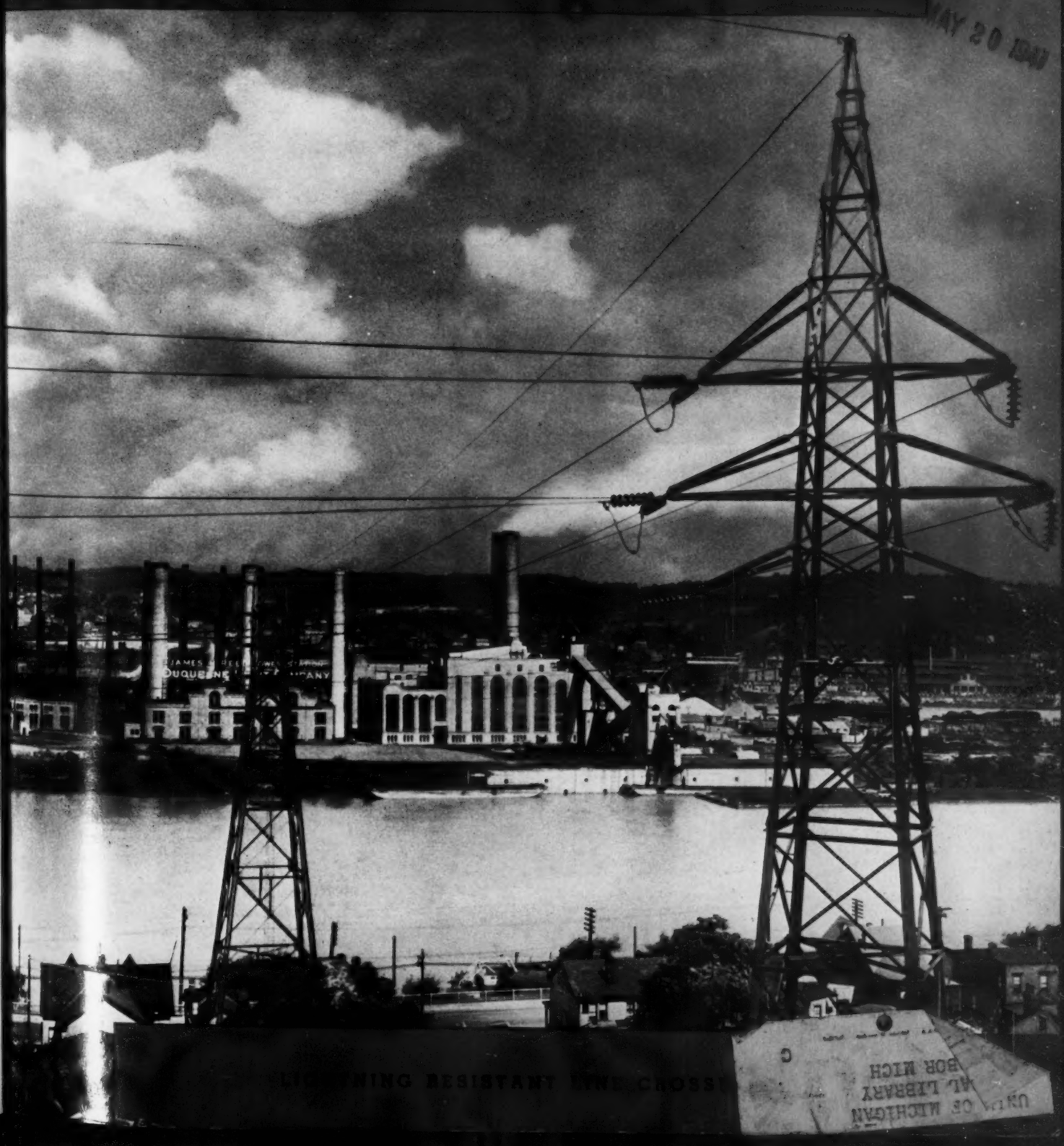
Electrical World

MAY 17, 1941



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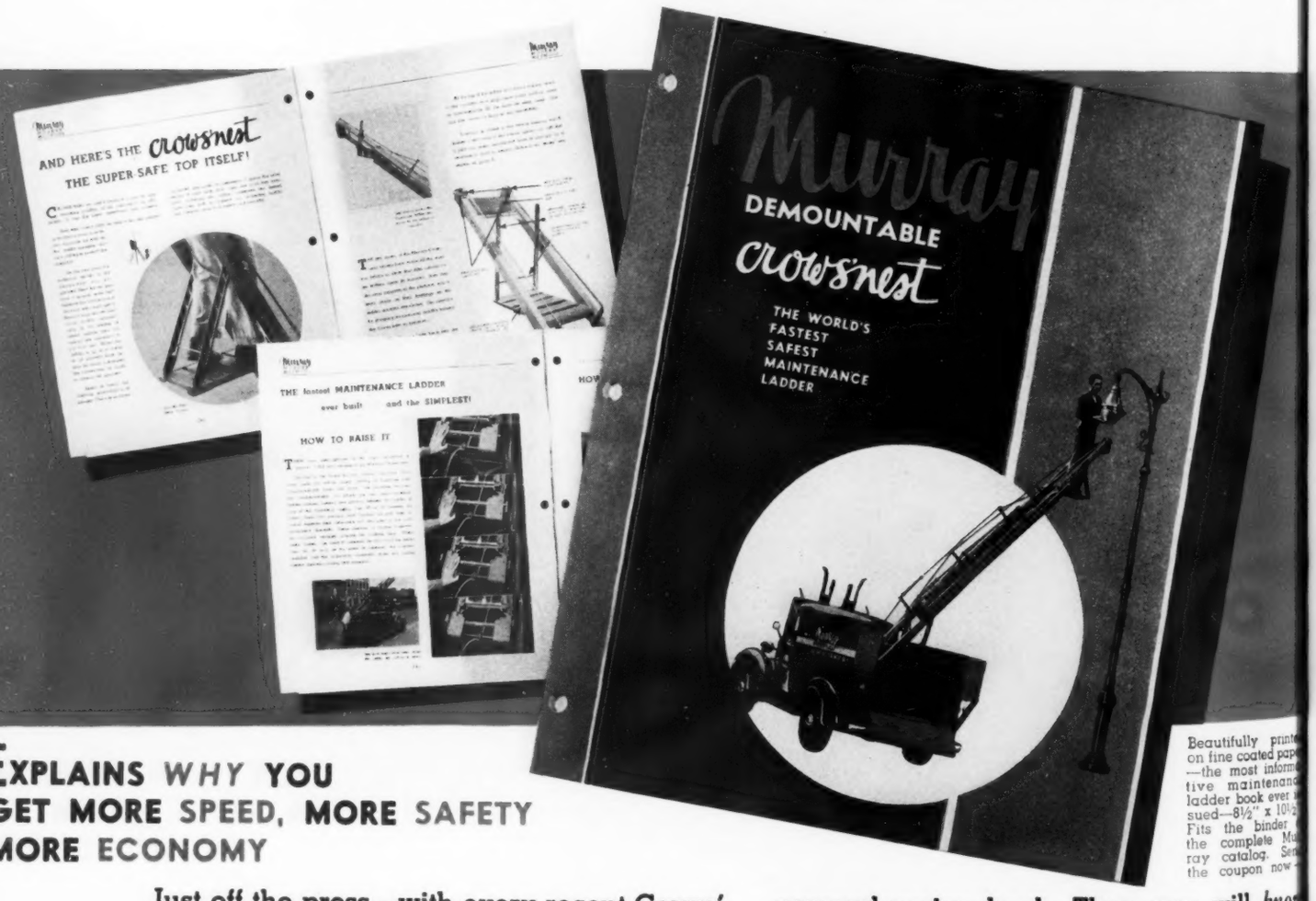

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Electrical World

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May 17, 1941

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JAMES H. McGRAW, Jr.....President
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MASON BRITTON.....Vice-Chairman
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ELECTRICAL WORLD • MAY 17, 1941

Why Advertise?

Electric light and power companies have no competition and therefore they should not advertise. Furthermore, when they do buy advertising space they do it to influence the press. This remarkable charge was made in Congress recently by a congressman from Oregon.

Perhaps this tirade by one disappointed over the results of the Spokane election ought not to be noticed, but there are elements in the situation that need to be brought out.

Utility advertising is partly to build new business, partly to hold existing business and partly to protect the whole business. Every one of these purposes has been recognized as a sound reason for advertising.

Where would the electric service business be today if the utilities had not promoted the use of electricity? Compare service here with service abroad and see the difference. Where would National Defense be if the utilities had not developed industrial usage until there is twice as much power behind the worker today as there was during the last war? Where would the electrical manufacturers be if the utilities had not developed the load markets for their products?

This took advertising, and the results are its defense.

It is true that the light and power business is a regulated monopoly in so far as one company alone is usually permitted to serve a territory. But there are other forms of competition. There is the competition from other kinds of service, such as, gas, both piped and bottled, Diesels, steam plants, ice and oil, and there is the competition from public ownership.

Inroads on the utility business are constantly being made by other services, and unless the advantages of electric service are continually kept before the consuming public the load mortality losses will become large. With the exception, perhaps, of lighting, there is no part of the utility load today that is not vulnerable to some form of competitive service.

To hold this load takes advertising, and again the results are the best defense.

And now we come to the crux of the complaint, advertising to protect the business against raids by public ownership. Admittedly the money comes from the customers. But what is wrong with that? Does not the public ownership crowd spend money? Whose money?

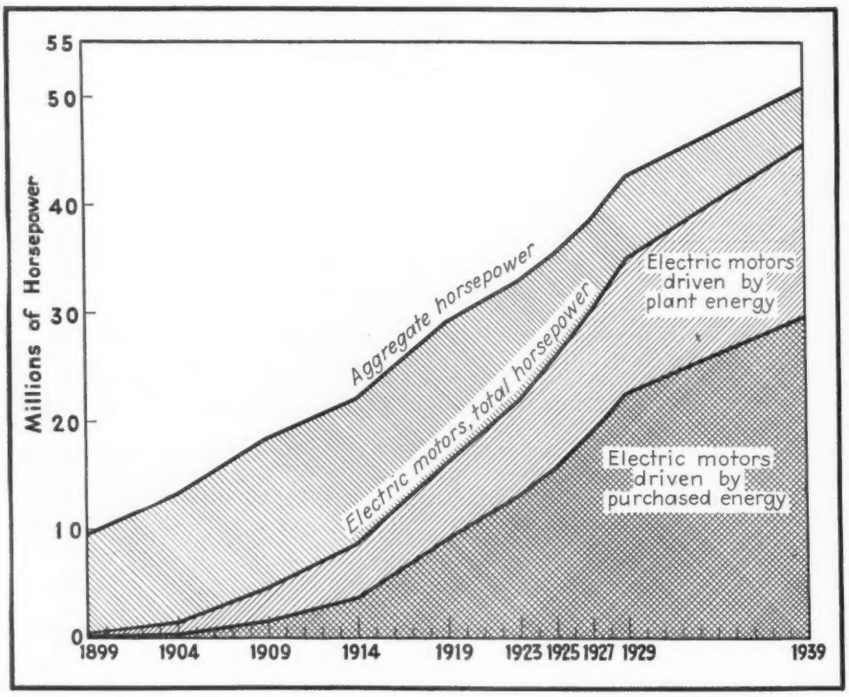
If it is wrong for private companies to build up good will and treat the cost as an expense, why does the government not clean out its own house first? TVA last year spent $166,000 for an information office.

It has never before in this country been a crime to protect oneself. In fact, the best defense against a murder charge is self-defense.

Advertising needs no more defense here either.

American Industry Is 90 Percent Electrified

Census data show advance in industrial electrification from 5 percent in 1899 to nearly 90 percent in 1939 — Purchased energy drives 65 percent of all electric motors in American manufacturing plants



IN FORTY YEARS electrification of American industry (ratio of total horsepower in electric motors to aggregrate horsepower) expanded from 5 percent to nearly 90

PURCHASED energy drove 65 percent of the electric motors in American manufacturing plants in 1939. Electric motors driven by purchased energy accounted for 58.5 percent of the 51,154,523 aggregate horsepower reported for 1939. And American industry was 89.8 percent electrified (ratio of horsepower in electric motors to total horsepower)!

These and other comparisons may be made from the Census of Manufactures, 1939, compiled by the Bureau of the Census, which makes this data available for the first time since 1929 (ELECTRICAL WORLD, July 23, 1932). Knowing that there were 7,887,242 wage earners in American industry in 1939, one finds that each worker had an average of 6.5 hp. at his disposal. In 1929 there were 8,838,743 workers, but each one had only 4.9 hp. to help him at his task. Going back to 1899, when industry was only 5 percent electrified, each of the 4,712,763 workers had a mere 2.1 hp. as a helper.

In the decade from 1929 to 1939 American industry made a gain of 8,223,462 hp., or 19.2 percent. Electric motors driven by purchased energy accounted for 7,112,302 hp. of this increase and showed an advance of 31.2 percent over 1929. The remaining 1,111,160 hp. was made up in prime-mover installations, which had a rise of 5.5 percent in the ten-year period. Incidentally, electric motors driven by plant energy registered a gain of 3,702,882 hp., or 29.9 percent, from 1929 to 1939.

To drive their electric motors—and for other purposes—the manufacturing plants purchased a total of 45,040,866,703 kw.-hr. in 1939, as against 37,393,833,046 kw.-hr. in 1922, a gain of 21.2 percent. (The Edison Electric Institute reported sales to commercial large light and power consumers totaling 51,108,000,000 kw.-hr. in 1939.) In addition, industrial plants generated 28,749,939,758 kw.-hr. and sold 2,922,939,919 kw.-hr. of this amount to other manufacturing establishments or to the general public. (No corresponding data are available for earlier years.)

Generators Gain 24%

Of the total of 21,266,557 hp. in prime-mover installations in 1939, manufacturers reported 1,996,573 hp., or 9.4 percent, as ordinarily idle. Driving electric generators took 65.6 percent of the total prime-mover horsepower. These electric generators had a total rating of 9,674,934 kw. in 1939, as against 7,793,875 in 1929, a gain of 24.1 per cent. Approximately 10 percent of the total generator rating was reported as ordinarily idle. For the first time type of prime movers driving the generators is shown, the returns indicating that 70 percent were driven by steam turbines.

For census purposes the manufac-

Prime Movers, Motors and Generators in American Manufacturing Industries, 1899 to 1939

Year	Aggregate Horsepower	Prime Movers, Horsepower	Electric Motors Driven by Purchased Energy		Electric Motors Driven by Plant Energy		Electric Generators, Kilowatts
			Number	Horsepower	Number	Horsepower	
1899 [1]	9,960,980	9,778,418 [3]	.....	182,562	16,891	310,374	.....
1904 [1]	13,296,394	12,854,805 [3]	.....	441,589	73,119	1,150,886	.....
1909 [1]	18,551,737	16,802,706 [3]	199,309	1,749,031	189,545	3,068,109	.....
1914 [1, 2]	22,290,899	18,406,175 [3]	447,502	3,884,724	321,323	4,938,530	.....
1919 [1, 2]	29,327,669	20,043,170 [3]	976,463	9,284,499	486,874	6,969,203	.....
1923	33,094,228	19,728,565	1,445,003	13,365,663	616,422	8,821,551	.....
1925	35,772,628	19,903,800	1,724,180	15,868,828	772,445	10,254,745	6,887,045
1927	38,825,681	19,693,371	2,151,675	19,132,310	790,810	11,219,979	7,345,685
1929	42,931,061	20,155,397	2,724,843	22,775,664	852,432	12,376,376	7,793,875
1939	51,154,523	21,266,557	4,138,169	29,887,966	1,224,637	16,078,658	9,674,934

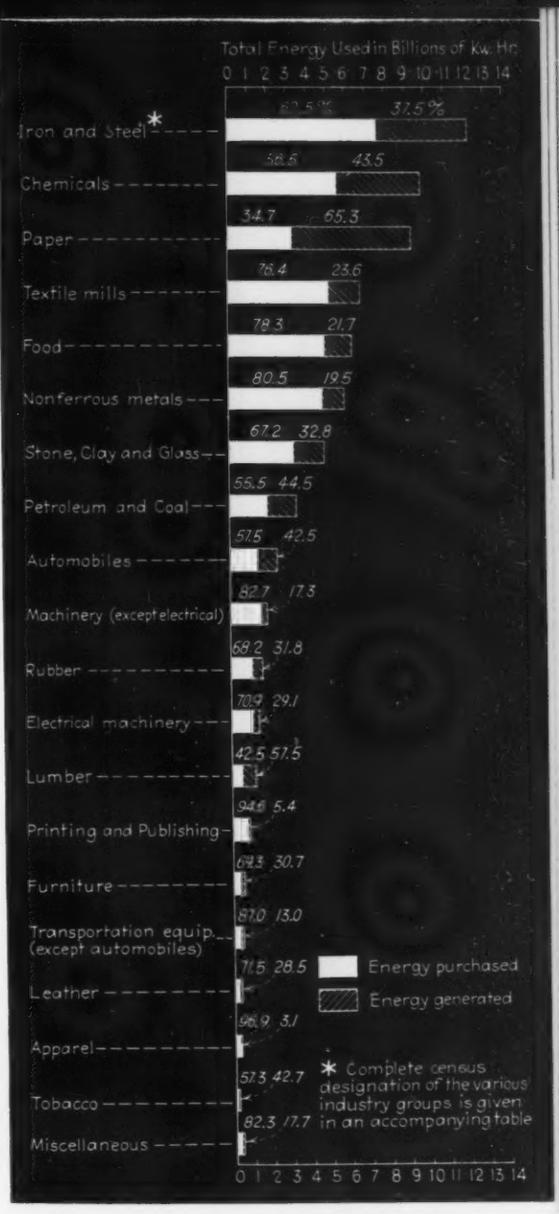
[1] Figures for 1919 and earlier years are not strictly comparable with those of 1923 and subsequent years because of change from $500 to $5,000 in the minimum value-of-products limit.

[2] Figures for 1914 and 1919 have been adjusted by subtracting data for establishments in "Automobile repairing" industry, which was not canvassed in connection with censuses of manufactures for any of the other years covered by this table.

[3] Totals do not include data for "Rented horsepower other than electric" and therefore differ slightly from corresponding totals given in reports for 1919 and earlier years as originally published.

turing industry is divided into 20 groups. Of these, the iron and steel classification is still the largest user of electric energy as well as the largest electric utility customer. In 1939 this group purchased 7,652,601,022 kw.-hr. and generated 5,948,991,443 kw.-hr., selling 1,363,681,786 kw.-hr. Because of the nature of the process, the paper industry was the largest user of plant-generated energy, accounting for 6,347,237,423 kw.-hr. of the total for all industries. However, it still purchased more than one-third of all the electric energy it used. An allied industry group, the printing and publishing classification, was the second largest customer, percentage-wise, of utility energy, purchasing 94.6 percent, or 812,741,418 kw.-hr. of its energy requirements. The apparel, etc., industry group bought 96.9 percent, or 345,215,649 kw.-hr. of its energy.

In 1929 there were only sixteen industry groups, so that perhaps the 1939 groups are not strictly comparable. It appears, however, that the textile mill industry continued the trend that was developing in 1929 and showed a decrease in aggregate horsepower for 1939 over 1929. The combined machinery groups showed a smaller horsepower in 1939 than the single group did in 1929. The "miscellaneous" group also showed a decrease, probably attributable to changes in census classifications.



PURCHASED ENERGY accounted for 64 percent of the total electric energy used by American industry in 1939—nearly 71 billion kw.-hr.—little more than a third being generated at the manufacturing plants

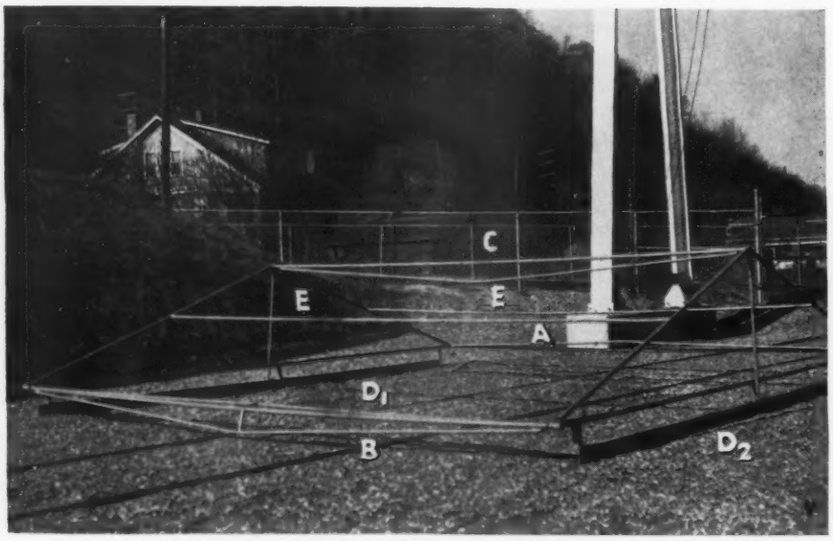
Prime Movers, Motors, Generators and Electric Energy by Industry Groups, 1939

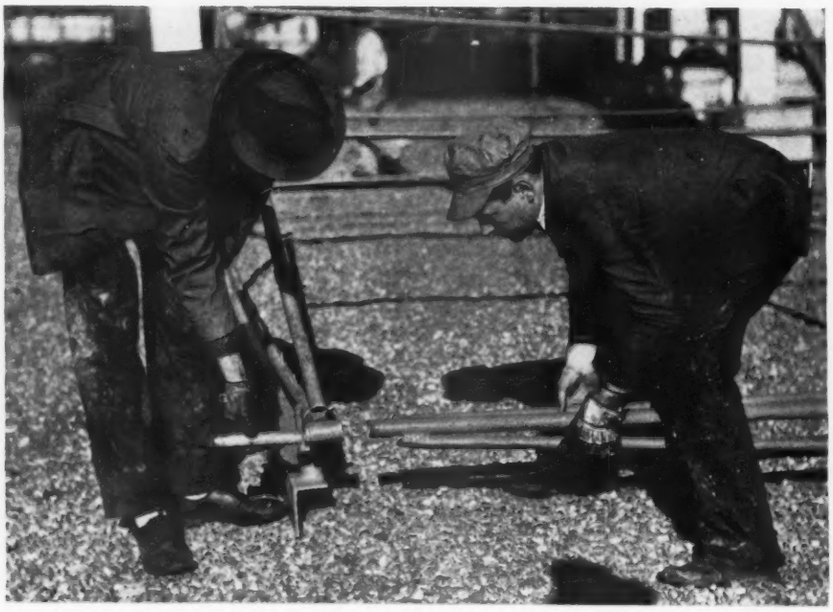
Industry Group	Aggregate Horsepower	Prime Movers, Horsepower	Electric Motors Driven by Purchased Energy		Electric Motors Driven by Plant Energy		Electric Generators, Kilowatts	Electric Energy in Thousands of Kilowatt-Hours		
			Number	Horsepower	Number	Horsepower		Generated	Sold	Purchased
All industries — total	**51,154,523**	**21,266,557**	**4,138,169**	**29,887,966**	**1,224,637**	**16,078,658**	**9,674,934**	**28,749,940**	**2,922,940**	**45,040,867**
Food and kindred products	5,641,424	1,985,395	610,645	3,656,029	122,115	996,127	720,413	1,469,504	79,809	4,998,209
Tobacco manufactures	100,511	49,665	22,248	50,846	6,878	29,815	31,512	52,666	3,642	65,675
Textile-mill products and other fiber manufactures	3,666,365	1,441,001	503,372	2,225,364	183,040	955,252	917,169	1,773,975	171,556	5,197,651
Apparel and other finished products made from fabrics and similar materials	249,019	25,257	215,081	223,762	5,917	11,957	14,605	12,379	1,298	345,216
Lumber and timber basic products	2,604,134	1,687,664	68,911	916,470	52,664	792,655	531,935	896,293	184,833	526,117
Furniture and finished lumber products	1,350,801	406,360	139,968	944,441	53,861	305,852	181,084	190,704	5,525	417,938
Paper and allied products	4,129,203	2,792,900	116,367	1,336,303	101,388	2,162,116	1,546,870	6,347,237	211,864	3,258,228
Printing, publishing, and allied industries	771,673	53,679	308,713	717,994	10,805	45,909	33,088	49,684	3,217	812,741
Chemicals and allied products	4,062,680	2,106,028	189,066	1,956,652	137,449	1,250,392	1,103,147	4,433,408	176,215	5,554,226
Products of petroleum and coal	2,404,898	1,386,007	40,788	1,018,891	26,970	751,474	406,946	1,646,097	115,180	1,909,267
Rubber products	989,927	288,170	58,161	701,757	18,536	281,575	167,248	507,633	5,007	1,081,811
Leather and leather products	460,030	150,166	95,913	309,864	19,498	108,258	88,972	135,882	21,177	287,149
Stone, clay, and glass products	3,036,671	947,183	148,254	2,089,488	41,390	901,558	517,256	1,627,283	34,182	3,258,523
Iron and steel and their products, except machinery	12,652,676	5,374,736	490,170	7,277,940	159,916	5,070,459	1,877,701	5,948,991	1,363,682	7,652,601
Nonferrous metals and their products	1,884,464	671,692	136,984	1,212,772	26,318	341,218	412,526	1,473,782	311,771	4,793,569
Electrical machinery	1,019,323	354,449	186,174	664,874	63,786	352,003	248,697	470,058	53,294	1,014,843
Machinery (except electrical)	2,611,997	434,109	383,399	2,177,888	72,996	568,528	253,494	353,291	10,799	1,642,923
Automobiles and automobile equipment	2,246,966	853,672	230,262	1,393,294	85,386	838,069	502,339	1,174,420	128,347	1,421,310
Transportation equipment, except automobiles	706,663	131,924	61,605	574,739	16,845	251,522	60,641	67,203	4,435	419,460
Miscellaneous industries	565,098	126,500	132,088	438,598	18,879	63,919	59,291	119,450	37,107	383,410

Portable Tent for Transformer Field Work

Repairs, maintenance and tests on large transformers made under portable shelter assembled on transformer lifting structure in half a day

F. G. GRANDIN, Appalachian Electric Power Company, Charleston, W. Va.





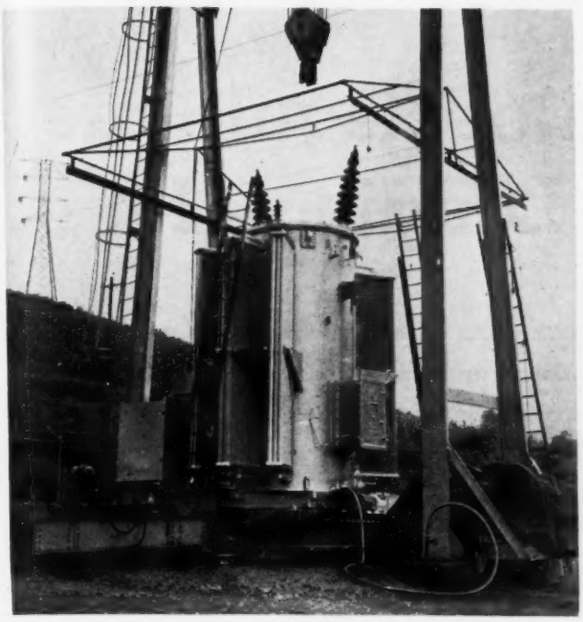
IN CONJUNCTION with our 50-foot transformer lifting structure it has proven advantageous to use a portable tent-type shelter for the overhaul and test of the power transformers. This has been in almost continuous use for three years and seems to have durability for several additional years of service.

The first cost is substantially less than the cost of the wooden shelter previously used in the case of major transformer repairs at outdoor stations. They took several days to erect and offered little opportunity for salvage of the lumber used in each instance.

The tent can be installed and the lifting structure ready to house the transformer on which work is to be done in half a day.

FIG. 1 (top)—Tent supporting structure can be assembled for attachment to the transformer-lifting structure. End sections D_1 and D_2 are bolted to lifting structure legs. Side sections A and B are placed by inserting pins (see Fig. 2) and top section C likewise. Sections E are set in sockets

FIG. 2 (below)—Pins tie ends of side frame to back supporting brace. A ⅜-in. bolt is inserted by the man at the right (working from a ladder), while the other man sits on the side brace (left). The structure is made largely of 1¼-in. pipe



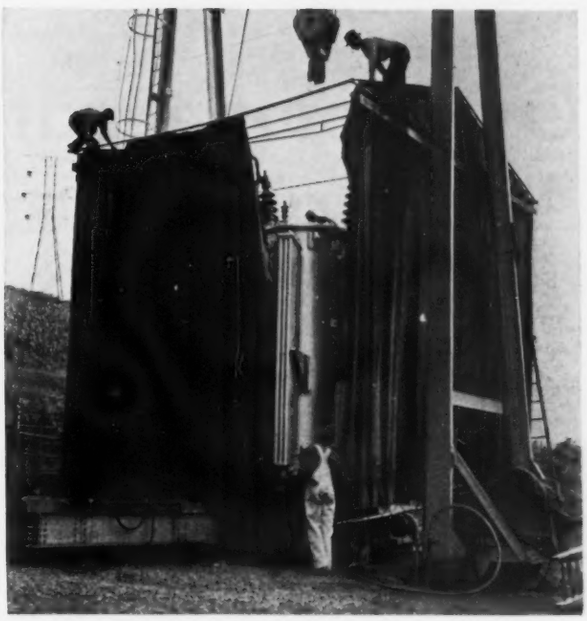


FIG. 3 (left)—Tent frame assembled on transformer lifting structure. FIG. 4 (right)—Side sections of tent are hung first. The rear end and the roof are one piece and are placed next. The roof is really a flap on the rear piece and can thus be turned over without forming a pocket at the juncture

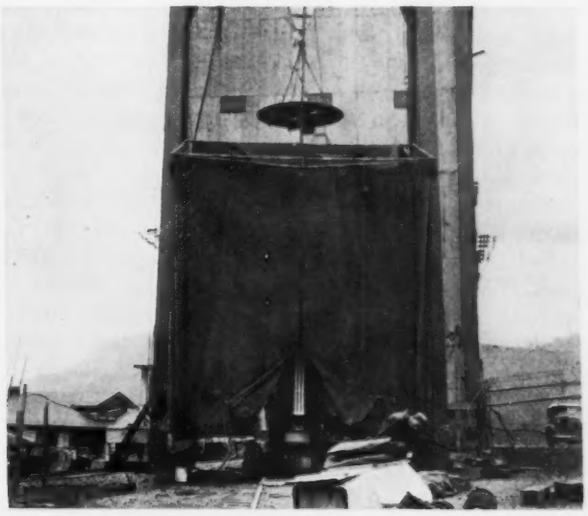
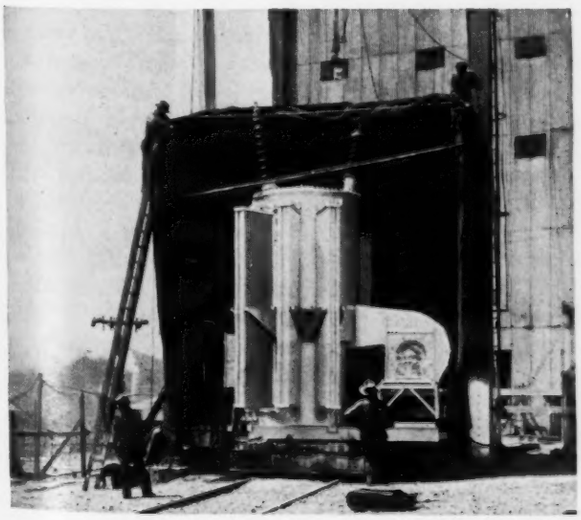


FIG. 5 (left)—Side of front section unhooked while transformer is moved into tent. After transformer is in, front section of tent is lifted over the top of the transformer. FIG. 6 (right)—Roof rolled back to permit removing transformer cover or untanking



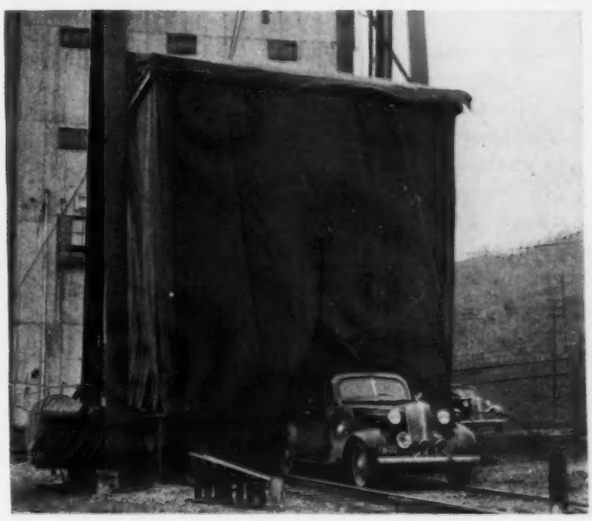


FIG. 7 (left)—With bushings in place, it may occasionally be necessary to remove the front brace of the tent structure to move overhauled transformer out. FIG. 8 (right)—Doble test truck backed into tent for wet-weather dielectric inspection

Overcompensation of Regulators Aids Voltage and Loading—I

Careful calculation of overcompensating settings of voltage regulators on express feeders resulted in improvements on a system subjected to abruptly increasing load

P. J. CARLIN and L. L. STAHLER, Florida Power & Light Company, Miami*

WHEN the peak load on this company's system had grown from 92,000 kw. in 1936 to 110,000 in 1937, with no prospect of let-up, it became of utmost importance that existing equipment and circuits be made to carry maximum loads. Previously little trouble had been experienced in maintaining desirable voltage levels at consumer entrances. As a consequence the adjustment of regulators was not very stringently controlled. Under the pressure of quickly accelerated loading a program of overcompensating the compensators of induction and step-regulators was adopted. It has greatly improved secondary regulation and, in effect, increased the capacity of all regulated feeders on the system.

Circuits Checked

All circuits were investigated for load-hauling ability and the then current practice of induction regulator compensator adjustment was carefully checked. It was found that compensator settings were determined by a method of trial and error; that is, by varying the resistance and reactance settings until the voltage desired at the end of the express feeder or point of regulation was obtained. Prior to 1935 approximately 118 volts had been held at the end of the express feeders throughout the system and, the circuits being lightly loaded, the resultant voltage at the consumer's premises had averaged approximately 115 volts.

As the load on various circuits increased after 1935 the voltage at the end of the express feeders was gradually increased to 120-121 volts, and in some cases to a somewhat higher value in an effort to maintain approximately 115 volts at the consumer's premises during peak-load periods. It followed naturally that some consumers received higher than the desired voltage at light-load periods, since the voltage at the end of the express feeder was held constant at all times.

The more common condition found was that of maintaining a flat 120 volts at the end of the express feeder, which held the voltage at the consumer's premises to 118 or 119 volts during light-load periods, but frequently resulted in very low voltage at peak load periods (see Fig. 1).

This condition had suddenly become common in many parts of the system as a result of the rapid load growth and it became necessary to institute corrective measures immediately. To obtain the necessary reduction in voltage drop by installing larger conductors or additional feeders would have been tremendously expensive and could not be considered except in isolated cases.

The feeders and regulators had reserve capacity, and in most cases the regulators had reserve voltage range, or if reserve voltage range was lacking the bus voltage could be raised to a higher level by utilizing power transformer taps or by the installation of permanent voltage boosters on the individual express feeders.

It was recognized that the secondary regulation could be improved by overcompensating the regulators and allowing the primary voltage at the end of the express feeder to vary with the load, rather than being held to a fixed value, and allowing the consumer's voltage to vary with the load.

Before this could be done a decision had to be reached concerning maximum and minimum voltages. The minimum voltage was fixed by the company rates and practices at approximately 115 volts. This fixed the no-load voltage at approximately 115 volts and also fixed the setting of the regulator voltage control relay at the same level.

Average Voltage Drop

To determine the maximum voltage it was necessary to resort to approximations (Fig. 2) of average voltage drops at peak load from the end of the express feeder through the primary, transformer, secondary and service to the consumer's premises.

Having determined the basic limitations indicated in Fig. 2 it was next necessary to work out a method of calculating overcompensated compensator setting which would give the desired result, and one circuit was dedicated to experimental purposes.

Only the first and final trials will be discussed.

The first trial was based on the

* Adapted from recent paper before Engineering and Operations Section, Southeastern Electric Exchange. A preceding article dealt with synchronous condenser, capacitors and step-voltage boosters, "Electrical World," April 5, 1941.

reasoning that since it was desired to hold approximately 115 volts at the average consumer's premises, it followed that if the total reactance and resistance were determined from the substation bus through the express feeder, primary lateral, distribution transformer, secondary and service it would only be necessary to introduce these values in the compensator circuit and adjust the regulator voltage control relay at approximately 115 volts.

The results were anything but satisfactory. Voltage varied widely between phases and the consumer's voltage varied almost as widely as under the former method of holding a constant voltage at the end of the express feeder.

Primary Capacitors Involved

Eventually the difficulty was recognized as being due to the presence of static capacitors installed on the primary in the vicinity of the feeder center, resulting in a much higher power factor and less ampere load on the express feeder than existed on either the primary, transformers, secondaries or services, with further difficulty being caused by the different reactance of the primary conductors due to the difference in spacing.

The effect of power factor improvement on the load-hauling ability of an express feeder and the effect of power factor improvement on customer voltage unless compensating adjustments are made in the line drop compensator are also shown in Fig. 2.

In developing the diagram of Fig. 2 the triangles representing the resistance and reactance drops through the service, secondary, transformer and primary lateral are developed and plotted as shown from A through B, C, D, to E. The angle of the IZ drop of the express feeder is then determined and plotted extending the resulting line EF until it intersects the voltage corresponding to bus voltage plus maximum range of the regulator, or in this diagram 125×1.10 or 137.5 volts.

The length of the line EF is equal to 17 volts or the maximum permissible IZ drop in this feeder under the conditions assumed, or is equal to $17 \times PT$ ratio or 340 primary volts. The express feeder is composed of No. 4/0 copper with a mean spacing of 55 in. and the impedance is 0.72 ohm per mile.

Since $IZ = 340$, then I must equal $\frac{340}{0.72}$ or 472 amp. This is the maximum current which can be transmitted by one conductor for a distance of one mile with a drop of 340 primary volts.

Converting this to kva., based on the voltage maintained at the end of the express feeder, we have the equation $\frac{3 I E_v}{1{,}000}$ $= \text{kva. or } 3 \times \frac{472 \times (124.5 \times 20)}{1{,}000} = 3{,}525$ kva. miles.

This is the capacity of the express feeder, which is to say that 3,525 kva. can be transmitted one mile or 1,762 kva. can be transmitted two miles with 17 secondary or 340 primary volts IZ drop.

Note that although the power factor at the consumer's main line switch is 90 per cent, it becomes 85 per cent at the regulator.

Assume that sufficient capacitors are installed at the end of the express feeder to correct the power factor as recorded at the regulators from 85 per cent to 95 per cent.

In effect, the current vector I is rotated counter-clockwise through 13 deg. to position I'.

Capacitors Rotate Triangle

If the regulators are compensated to maintain constant voltage at the average consumer or point A, then the compensator circuit is equivalent to the triangle AGF, and any change in power factor on the circuit will be recognized by the regulators as occurring at point A, irrespective of where the capacitors are installed. Therefore, the installation of capacitors at the end of the express feeder or point E results in the rotation of the impedance triangle AGF around point A rather than resulting in the rotation of the impedance triangle EHF around point E, as would have occurred had the regulators been compensated to maintain flat voltage at point E.

It follows that points E and F will rotate counter-clockwise around point A to points E″ F″ respectively, assum-

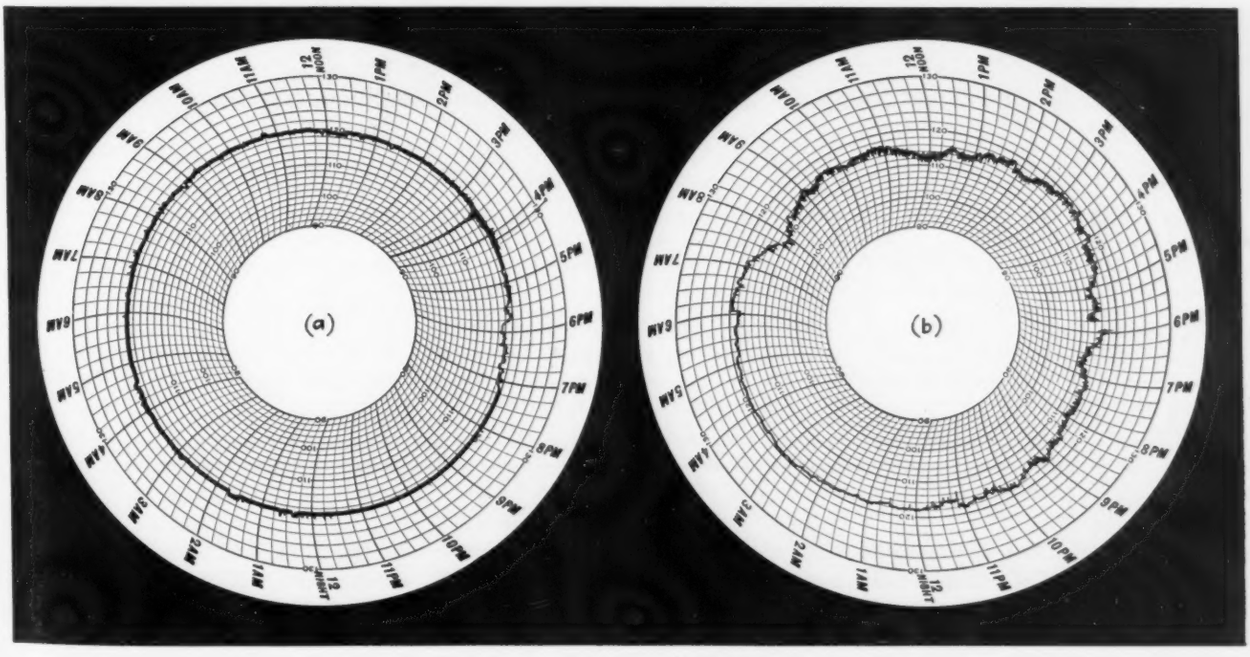


FIG. 1—Conventional compensation on the express feeder does not give desirable voltages along the laterals

(a) Voltage at end of express feeder with regulator compensated only for drop in express feeder.

(b) But that gives this kind of voltage on the primary at the end of a lateral served from the express feeder. Note the dips due to cooking loads at 8 a.m., noon and 5 p.m. This chart was taken about 1 mile away from the junction with the express feeder.

These are primary-voltage charts; the 9 per cent regulation shown here becomes 12 per cent at the consumer service.

ing that the kva. load on the regulators remains constant for the purpose of developing this diagram.

Had the kw. load been increased as the reactance load was decreased, resulting in the same kva. on the regulator, the voltage control relay would have dropped the regulated bus voltage from F to F″, a decrease of 3 volts, and the voltage at the end of the express feeder would have been lowered from E to E″ or approximately 0.75 volt.

Actually the installation of capacitors not only will have changed the characteristics of the load on the express feeder but will have reduced it approximately 10 per cent under the conditions assumed, and the voltage relay will further drop the regulated bus voltage from F″ to F′, or 10 per cent of the line A-F″. This will reduce the voltage at the end of the express feeder from E to E′, a reduction of approximately 2 volts.

Now since the capacitors were installed at the end of the express feeder, their presence does not affect either the power factor or the load between that point and the consumer and the voltage drop in that section of the system is the same as before the installation.

Under these conditions the consumer voltage is reduced approximately 2 volts as shown by point A′. This demonstrates the effect of power-factor correction on overcompensated circuits and shows the need for compensator adjustments to meet power factor conditions.

Before leaving Fig. 2 it is desired to point out the principal advantage of power-factor correction, which is shown quite clearly by this diagram.

Note that after the power factor is corrected the regulated bus voltage is lowered from F to F″, or approximately 3 volts below maximum range of the regulator. Since the bus voltage and regulator range have remained constant, it is evident that the maximum *IZ* drop allowable in the express feeder is no longer represented by EF or E″ F″, but by this line extended to F‴ or to 137.5 volts.

Recalculating the value of the line E″-F‴, it is found that the hauling ability of the express feeder has been increased from 3,525 to 4,250 kva. miles by having corrected the power factor from 85 per cent to 95 per cent.

A subsequent installment will illustrate the necessity of varying the overcompensation components in the line-drop compensators on different feeders to meet the power-factor conditions prevailing on each individual feeder at time of maximum load.

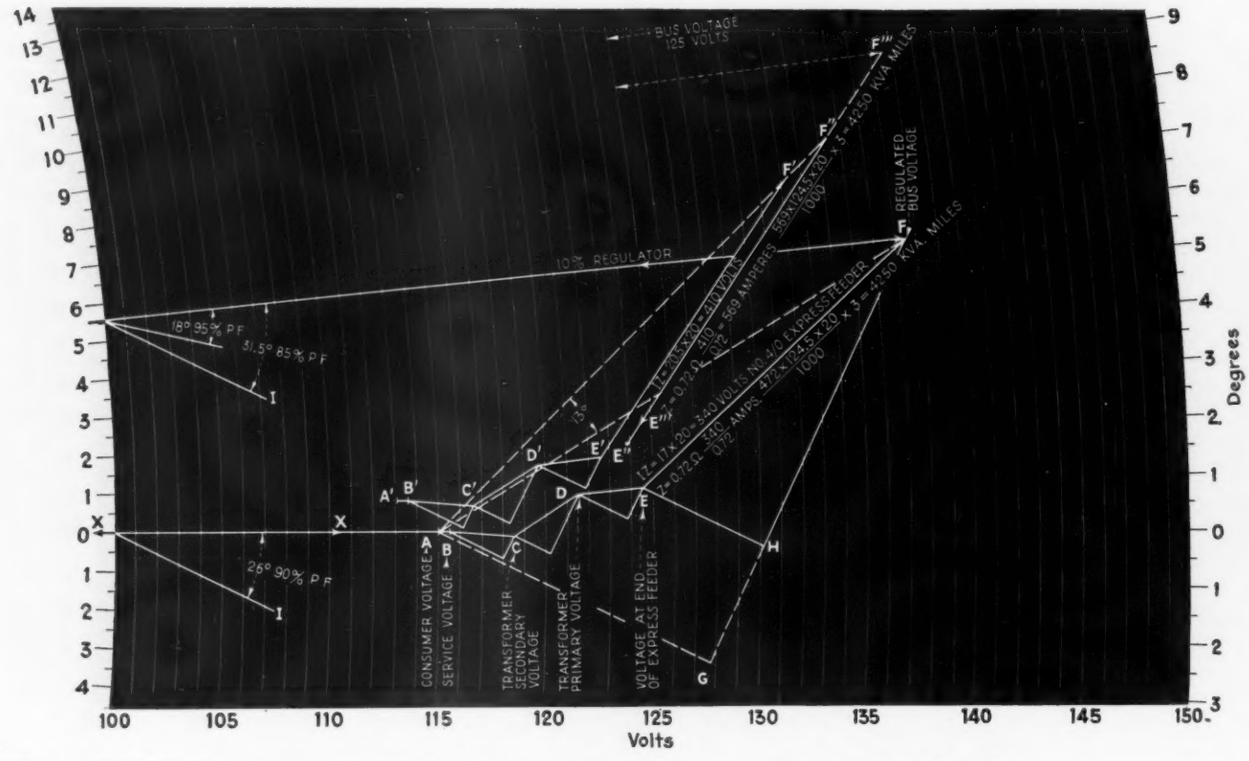


FIG. 2—ALLOCATION of voltage drops under maximum load for average conditions on typical feeder

The average primary is No. 4 copper, the average transformer is a 10 kva., the average secondary is No. 4 copper and the average service is No. 6 copper.

Services are designed for ½-volt drop, line AB; secondaries are designed for 3 volts drop at maximum load, line BC; 3 volts drop is allocated to the transformer at full load, line CD, and 3 volts to the primary laterals, line DE. From this it is seen that with full load on the regulators 124.5 volts is required at the end of the express feeder or point of regulation in order that the average customer may receive 115 volts at his main line switch.

Assumptions—The average power factor at the customer's main line switch is 90 per cent and current *I* lags 26 deg. behind the voltage X-X. Impedance of distribution system to average customer is sum of impedance of service, secondary, transformer, primary lateral and express feeder. These are plotted at the correct angles for the condition assumed from A through B, C, D, E to F, and when added together total the line AF, which is equal to the total *IZ* drop from the regulator to the consumer when the regulator is fully loaded.

Eternal Vigilance the Price of Distribution Economy

Constant supervision of details of organization, personnel, crew efficiency, safety, construction materials, right-of-way purchasing, automotive equipment, transformers proves profitable

GEORGE S. HUMPHREY, Vice-President Potomac Edison Company, Hagerstown, Md.*

ACTUAL ATTAINMENT of distribution economies is a matter of constant attention to many details by many men throughout their daily work. Such economies in both material and labor can be obtained only by sympathetic co-operation of people who are interested in securing them. Occasionally some good idea will appear which will result in a large economy, but the many little economies that can be made daily by many men scattered over the whole property bulk very large in the aggregate. This is not one of those problems which can be solved and put on the shelf for a time, but one must be constantly on the alert, ready to recognize and take advantage of any possible economies through the varying situations as they come up.

Efficiency Checks

During the past five years the number of customers served by Potomac Edison Company has increased 20 per cent (to 80,000), the number of poles has increased 25 per cent (to 115,000), working hours have been reduced 17 per cent, and yet our line force has increased only 7 per cent. This is partly due to efficient functioning of organization and personnel, partly to factors of design and construction and partly to improved methods of operation and maintenance. Some of these measures will be enumerated.

As a rough check on the efficiency of line work in the various districts, we prepare annually curves showing for each district the number of men in the line department per thousand poles and per thousand customers, plotted against the average number of poles per customers. The thinner the territory, the more help will be required per thousand customers and the less help per thousand poles. Considering the number of poles per customer roughly takes into account the variation in density of customers between the various districts. Any district which is materially above this curve needs some attention to see whether or not the full force is necessary, while any district falling below the curve needs checking up to see whether or not the work is being properly handled with the force at hand. There are several factors influencing the number of men required which are not taken into account in this rough comparison, but it does serve as a ready check and is quite helpful in keeping tab on the various district forces under the changing conditions from year to year. This same method can be used to check on automobiles and trucks, operating expenses, etc.

Slips and Preventions

For several years we have been publishing a little paper entitled *Slips and Preventions*. In this we recite the details of accidents which resulted in injury, or careless acts which might have resulted in injury, but did not. Attention is called to slips in engineering or supervision which resulted in unnecessary extra expense, or caused unnecessary trouble to some customer. Occasionally some especially good performance of some employee will be commended. Individuals' names are not mentioned in these articles, but of course they are always known by those directly concerned. This paper was first issued quarterly, but available material has now diminished so that it is issued only semi-annually. This change bears witness to the benefit which has been obtained from this practice.

Economies

There is a natural clash between economies of construction and economies of operation and maintenance. The more there is spent wisely on construction, the less should be required for operation and maintenance, and *vice versa*. To get the proper balance, one must evaluate the additional fixed charges for any items of increased cost against the probable savings in operation and improved service.

We buy all of our line materials according to specification, using in most cases the specifications which are generally accepted in the trade. We have a lot of notions about things we would like to have changed, but if they involve additional cost we are inclined to go along with the standard.

We believe it pays to inspect most of the distribution line materials, provided it can be done at reasonable cost. Our pine poles are all inspected at the treating plant by an outside organization. All other materials are inspected upon receipt by us at our general storeroom. This makes our

* Abstract of paper presented at recent meeting of Southeastern Electric Exchange, Savannah.

inspection cost a minimum, and the suppliers have accepted this policy with but few objections. It is only occasionally that materials must be rejected. Such rejected materials that are regarded as not serviceable are returned to the manufacturer at his expense. For materials which do not meet the specifications, and yet are considered as quite serviceable, we are willing to pay the supplier a reduced price and use them.

Construction Plans

Each work order for a line extension is accompanied by a sketch which shows in detail the size and location of each pole, guy, transformer and customer, and also the kind and size of conductors. It also shows the location of interfering trees and notes the arrangement made with the property owner for cutting or trimming the trees. In the interest of economy it is quite necessary for the line foreman to know exactly what he has to do, and the material that will be needed, before he goes on the job, so that he will not be held up for any lack of material, or information as to what is to be done, or be delayed by some irate land owner because proper arrangements had not been made for placing of the poles, cutting or trimming trees, etc.

One simple money-saving idea that hit us a few years ago was to have every man who gets much right-of-way become a notary public so that he can notarize the property owner's signature at the time it is obtained, rather than have to make a return trip with a notary.

For transmission lines, and occasionally for a distribution line at some critical spot, it is our practice to have right-of-way titles checked and certified by an attorney. However, for the usual rural line we do not think this expense is justified. The party obtaining right-of-way merely inquires from the property owner as to liens on the property and takes his word for it, occasionally doing a little checking of his own from the courthouse records. It hardly seems reasonable to spend $5 to $15 to have an attorney check a title for rural right-of-way which cost only $1.

We formerly thought it quite necessary to keep all grounds away from a transformer pole, in the interest of safety to the men. We now find that considerable economies are realized by grounding together the transformer case, arrester, secondary and any ground guys which may be on the transformer pole. Our men have learned to work just as safely with all of the grounded parts on the pole as they did previously when all grounds were so carefully kept away from the transformer pole.

It proves economical to use No. 4 scrap copper wire, or larger, coiled under the butt end of a pole before it is set in the ground, the wire being brought up above the ground. This makes an economical and satisfactory ground connection.

The cutouts we have been using with transformers are fairly satisfactory. However, we are still having difficulty with line sectionalizing cutouts to get fuse ratings that will operate properly in connection with other fused cutouts, and with oil circuit breakers, which are back of them.

We have recently installed twenty-odd single-pole reclosing pole-top oil circuit breakers which have given more economical operation and better service with a first cost not greatly in excess of repeating fuses.

Transformers

We have for several years been a consistent user of single bushing rural type transformers with an open drop-out type cutout mounted on the bushing and an arrester mounted on the side of the tank. This gives an assembly which is bolted directly to the pole, independent of crossbars. It affords greatest saving on corners, which are turned vertically. Many of our transformers are located on corner poles, particularly in sections where we disregard highways and build our lines straight from customer to customer, thereby obtaining the shortest line possible, and avoiding customer branches.

Temporary Measures

Sometimes it is necessary to take care of a temporary load, or of some unusual conditions which will last only a short time, which would require a large investment in new equipment to handle in the normal way. Occasionally a large saving can be made by working out some freak connection with standard transformers, or by making abnormal use of some other equipment on hand, which will tide over the temporary condition without buying any new equipment. We find it is worth a considerable effort to work out some such arrangement whenever a requisition comes along for some new equipment to meet such a condition, particularly if it is not standard equipment.

Operation and Maintenance

The first essential for economical operation and maintenance is good construction—good materials properly installed. If every pole is set to proper depth, every span of wire properly sagged, every ground connection properly made, every needed guy properly installed, every cutout properly fused and every threatening tree properly cut or trimmed, there is a favorable setting for economical operation. Anything which causes an interruption of any kind is uneconomical in two ways: (1) It is costly to locate and repair the trouble, and (2) it causes loss of revenue and reputation.

This emphasizes the importance of having proper specifications and also proper supervision to be sure that the specifications are actually followed.

It is also extremely important to have maintenance men properly spaced throughout the territory. In our case, to serve 80,000 customers we have 25 locations where we have at least one pick-up truck with two men, both able to do some climbing, to take care of the ordinary troubles in their territory. This makes an average of 3,200 customers handled from each location. At each of our eleven district headquarters we have one or more derrick trucks with full crews to take care of all construction and maintenance which cannot be handled by the two-men trouble crews. The largest of these districts handles about 15,000 customers and the smallest 2,500.

Automotive Equipment

The types of automotive equipment and tools used have always been of vital importance, and attain still greater importance with any decrease in working hours and increase in wages.

During recent years we have been buying trucks of higher quality and of greater speed. We are getting more and more mileage, both with

[*Continued on page 115*]

Distribution Losses Are Reducible

Larger transformers, longer secondaries, 4-kv. ring bus instrumental in lowering losses below 5 percent for South Carolina municipality

F. W. CHAPMAN,* Commissioners of Public Works, Greenwood, S. C.

ADMITTEDLY it seems questionable to reduce distribution system losses in ten years from 31 to 4¼ percent. However, no one so far has been able to expose any fallacy in the data or the conclusions about the performance of the municipal system serving the 12,000 people in Greenwood from a 2,500-kva., 44/2.3-kv. substation, connected to the Duke Power 110-kv. system. Substation losses are not included in these figures.

Energy has been distributed at 2.3 kv. from a centrally located substation since 1931 and over a single No. 4/0 copper ring 9,000 ft. long encircling the business section. Other loads have been served from this ring through radial taps which, except for the single phase, have been unfused. The resulting interruptions are expected to be reduced by an early installation of a new 4-kv. substation and three feeders, two of which are residential and one business and industrial. All have automatic reclosers.

* Superintendent.

Table I—Reductions in Percent Loss

1931	31.7	1936	10.7
1932	16.75	1937	8.5
1933	14.9	1938	6.09
1934	12.2	1939	4.25
1935	12.8	1940	4.6

Table II—Computation of Losses

	1939	1940
Energy purchased, kw-hr	7,751,080	8,181,140
Sales	6,640,964	6,837,279
Street lighting	440,985	420,195
Elec. dept. use	10,108	6,033
Water pumping	511,788	542,101
Unaccounted for	339,235	375,532
Percent loss	4.25	4.6

The reduction in losses pertains, however, primarily to the prior ring bus arrangement. It is attributable to a progressive change to a better primary system, larger transformers, longer secondaries, outdoor meters.

Average residential consumption has reached 1,400 kw.-hr. per year. System load factor is around 60 percent. Maximum demand is approximately 2,000 kw.

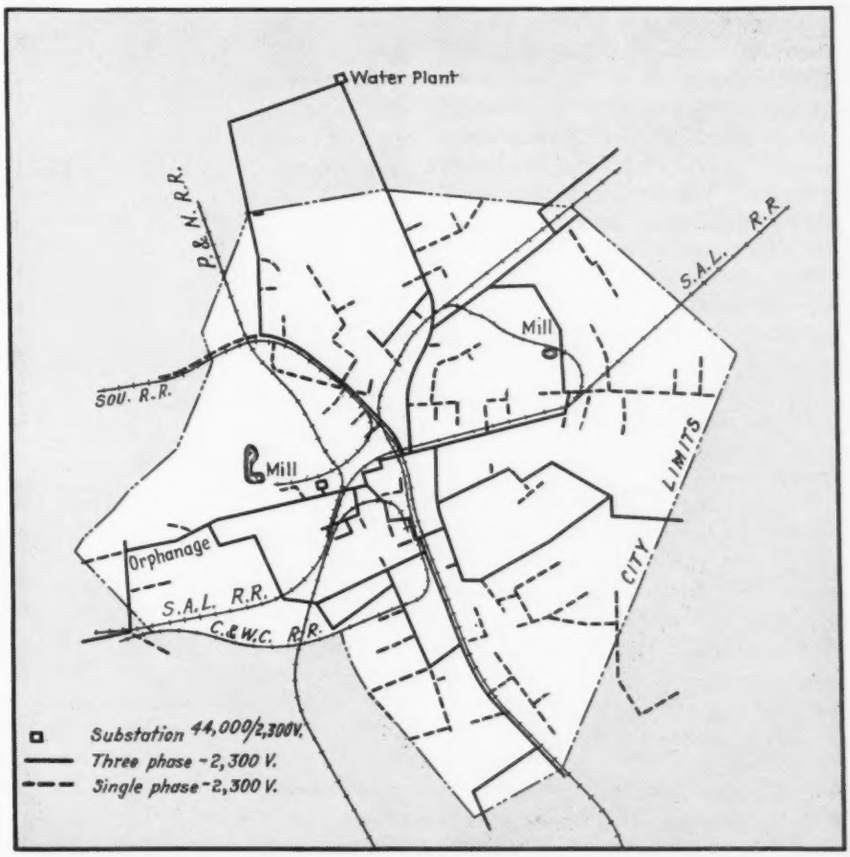
Prior to 1931 the substation was some 8,000 ft. from the load center and there were three circuits (No. 2/0, No. 2 and No. 6) feeding into the system. The centrally located substation was put in service with the ring bus early in 1932 and the halving of the losses of 1931 was due to that improvement.

Loss Reduction

In the early part of this ten-year period a small transformer had been installed for practically every range customer. Also, a typical business block was served by fourteen transformers, the largest a bank of three 10-kva. units. Some supplied three-phase, 220/110 volts, others only single-phase lighting. One three-phase bank and two single-phase transformers replaced the fourteen. The subsequent reductions in 1933–35 were accomplished by more such consolidations, with a view toward larger transformers even if they entailed longer secondaries. Free front porch lights were gradually eliminated during this same period; this reduced the unmetered, unaccounted-for energy.

In August, 1937, the rural lines

[*Continued on page 53*]



GREENWOOD distribution system cuts losses from one-third to one-twentieth of the purchased bulk supply

66-Kv. Ring Link Made Lightning Resistant

Lightning-proofing involves aerial coupling wire dictated by important coupling factor — Four-member wood arms with special hardware replace steel tower arms

W. R. METZGER, Duquesne Light Company, Pittsburgh, Pa.

THE Duquesne Light Company recently completed rebuilding two 66-kv. transmission lines, one 15.1 miles and the other 9.3 miles long, as part of a program for "lightning-proofing" the entire 66-kv. transmission system. The former steel arms on the steel towers were replaced with four-member wood arms and new designs of hardware were developed for their assembly. An underline ground wire (aerial counterpoise or coupling wire) was installed.

The system under consideration is essentially a ring, extending around the metropolitan district of Pittsburgh, and is comprised of approximately 120 miles of double-circuit line on steel towers. These lines were built many years ago and do not embody such features as are considered essential today to resist lightning.

Records show that approximately six out of seven faults are due to lightning, and that for the system 24 faults are due to lightning per hundred tower line miles per year and on the worst line this figure rises to 56.8. Of these faults about one-third are double circuit.

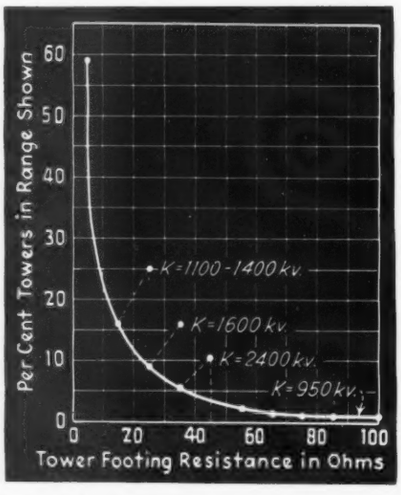
With the majority of faults due to lightning, it was evident that any substantial improvement of performance could be gained only by changes which would render the lines as nearly "lightning-proof" as possible.

Performance Analyzed

A complete analysis of the system was made to determine the degree of improvement that could be secured by various changes.

The basic theory underlying the calculations made in this study is that stated by Dr. Charles Fortescue in 1930 and since developed extensively by L. V. Bewley and others.

Briefly, the theory holds that line flashovers caused by lightning on high-voltage circuits are the result of strokes terminating upon (1) the conductor, (2) the ground wire or (3) the tower. In the first case the lightning current required for flashover is so low that it is permissible to assume all such strokes cause flashover. In the second and third cases flashover is dependent upon numerous factors, some of which are well defined and capable of accurate analysis, while others are indefinite and difficult to evaluate.



DISTRIBUTION of tower footing resistances with adjustments for various insulation levels

It will be immediately apparent that line protection falls into two principal phases:

1. Ground or shield wires must be located to prevent the termination of the stroke on a line conductor.

2. Assuming the stroke to terminate on the ground wire or tower, the various factors then governing must be co-ordinated to prevent flashover from tower or ground wire to the line conductor.

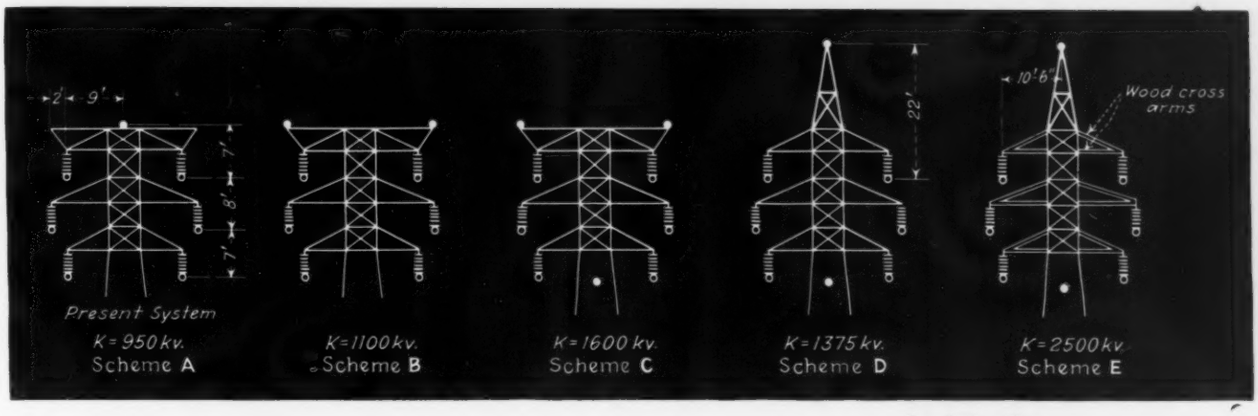
Field experience and laboratory tests yield conflicting conclusions with respect to the first, or shielding aspect, while the theory of this second part is abundantly verified by subsequent performance of well-designed lines.

Because our interest lies in the over-all answer to the outage problem, it has been necessary to place an arbitrary valuation upon the effectiveness of various ground wire configurations with respect to shielding the conductors from direct strokes. For this reason, the part of the data relating to this part was separately identified in the results and may be readily adjusted at such time as a more satisfactory evaluation is possible.

Ruling Factors

The principal factors governing the line performance under the assumption of perfect shielding are:

Magnitude and Shape of Lightning Stroke Current—Quite satisfactory field data are available on the magnitude of lightning stroke currents, but very limited data have been obtained on the wave shape. Magnitude data used were those presented by W. W. Lewis and C. M. Foust in "Lightning Investigations—VII," A.I.E.E., 1939, in the form of a distribution curve showing the percent strokes equaling or exceeding given current values.



PRESENT AND PROPOSED schemes for tower configuration. K = Tower insulation level = $\frac{\text{Insulation Kv.}}{1-(\text{Coupling Factor})}$

Calculations were made for a lightning wave front of one microsecond and for a wave front of three microseconds. The results for the one-microsecond front are presented as the more conservative.

Tower-Footing Resistances — A sample of the tower-footing ground resistances was obtained by actual measurements on 51 towers. From this sample the distribution curve shown in the accompanying illustration has been derived for use in the computations. The actual sample curve has been arbitrarily extended in the direction of higher footing resistance in order to include the effect of a few high values which would undoubtedly appear in a larger sample.

There is no fixed relationship between meggered resistance and impulse resistance values. Test results indicate that the impulse resistance value varies from 35 to 70 percent of the meggered resistance value. The amount of reduction depends upon the character of the soil and the value of the current. This factor was retained as a factor of safety in the calculations.

Impulse Strength of Insulation and Clearances—The impulse strength of suspension insulator strings and tower air clearances has been standardized, and these values are used in calculations. Midspun impulse sparkover values are conservative exterpolations from data on long air gaps. Data on wood and porcelain combinations are available and have been used to estimate the margin of safety between structural flashover and air clearance flashover at the tower. When wood arms are used the limiting impulse strength is normally assigned to the conductor-tower air clearance. Under certain conditions and with some unseasoned wood arms this co-ordination will infrequently fail to obtain, but it is not structurally feasible to design for absolute co-ordination. Proper selection of seasoned wood should render structural flashover extremely infrequent. Moreover, the dual-member wood arm design is such that the strength of the assembly is not seriously impaired even in the event one member is completely shattered.

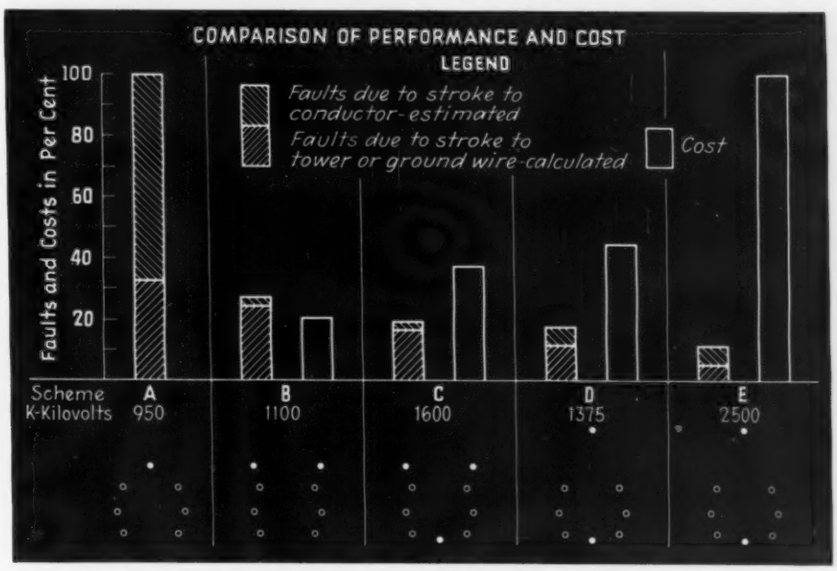
Surge Impedance and Coupling Factors of the Line—Surge impedance and coupling factors are calculated according to usual practice, taking into account a conservative corona effect.

Span Lengths—Span length affects the calculations by determining the time intervals elapsing before the parallel tower footing resistances of adjacent towers can aid the stricken tower, or ground wire point, by taking a share of the stroke current. All calculations are based upon 800-ft. span length, which is conservative for our system.

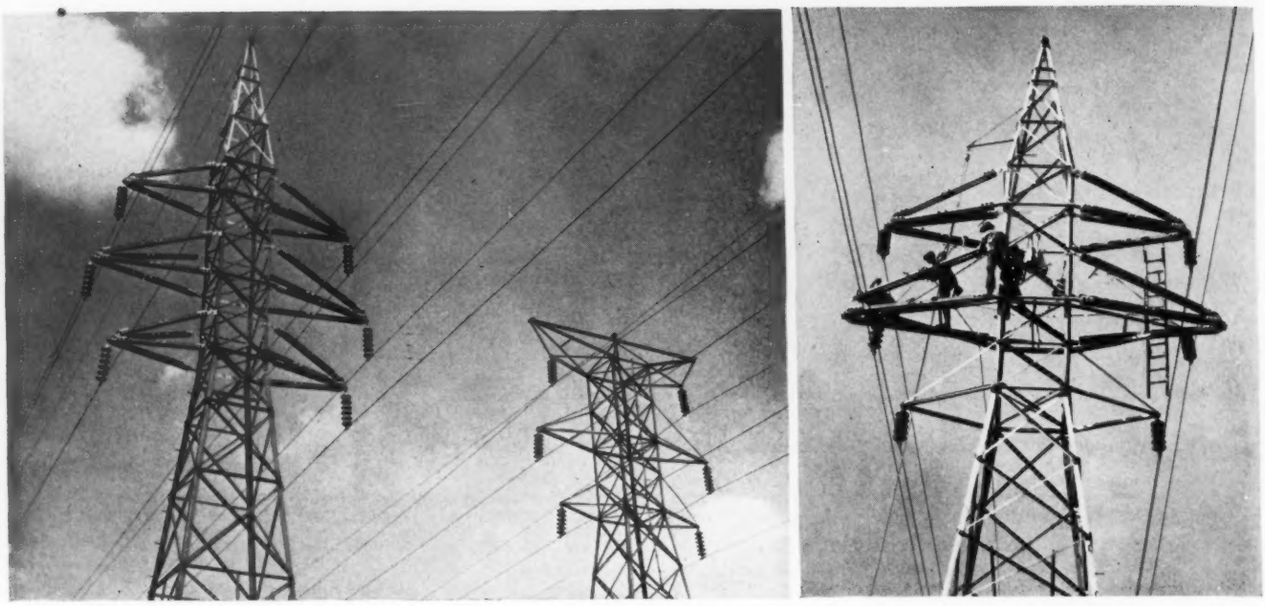
The methods used in calculating line performance have been selected in the light of theory, experiment and field experience with well-designed lines and are believed to embody all principal factors to a satisfactory degree of engineering accuracy.

Schemes Considered

A study of the basic principles and methods of improving line performance from lightning disturbances indicated that certain changes in arrangement of ground wires and phase conductors would be required to achieve the improvements in shielding and insulation levels desired. The structural limitations of our present towers were investigated and it was found that the towers are strong enough to make the following changes



SCHEME E most costly but gives lowest estimated fault performance



NEW WOOD ARM TOWERS alongside former structural design (left), being installed after removal of former steel arms (right)

without a major rebuilding of the entire tower:

1. Add a second overhead ground wire or raise the present one 15 ft. to secure the desired shielding level. Raising the present ground wire increases the phase-to-ground wire clearance and improves the midspan flashover performance.

2. In addition a ground or coupling wire can be added, under or near the elevation of the bottom phase wires, to raise the coupling factor.

3. Any increase in phase spacing to permit the use of longer insulator strings would require a major rebuilding of the towers. However, the increase in insulation can be secured by the use of wood instead of steel in the crossarms.

Various schemes were considered for rebuilding present towers:

Scheme A—Present system. Included for comparative purposes and to determine to what degree the various parts were contributing to the high failure rate.

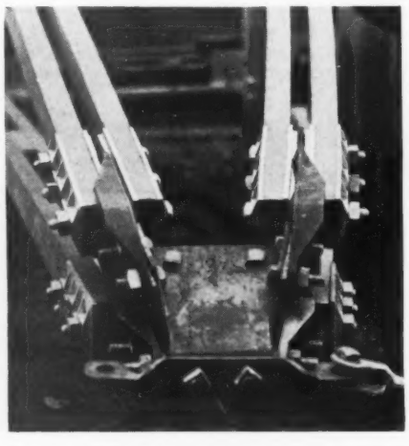
Scheme B—One overhead ground wire was added to the present system and all high tower footing resistances were reduced to a maximum of 25 ohms. This arrangement gives excellent shielding, but the phase to ground wire clearance is insufficient for mechanical reasons and gives poor midspan flashover performance.

Scheme C—Same as scheme B except with the addition of a third ground wire under the phase conductors. The maximum tower footing resistance permitted for this scheme is 35 ohms. The same disadvantages are present here as in scheme B. The lower ground wire improves the coupling factor so that an increase in effective tower top strength of almost 50 per cent is achieved.

Scheme D—The present ground wire was raised 15 ft. and a new ground wire installed under the phase conductors. The steel crossarms are retained. The maximum tower footing resistance permitted for this scheme is 25 ohms. Raising the ground wire gave satisfactory shielding and improved midspan flashover performance.

Scheme E—Same as scheme D except the steel crossarms were replaced with wood and the maximum tower footing resistance is 45 ohms. This change added very materially to the insulation strength of the towers.

The wood crossarms are of dual construction for all members and are so designed that the splintering or failure of any member will not affect the support of the line. Any wood member that fails can readily be replaced at some convenient time after the storm. From experiences of other companies most failures of this type appear on new construction and after a period of a year or so the percentage of failures becomes almost negligible. Properly seasoned wood will do much to eliminate these early failures. The wood selected is treated fir with a cross-section of 2 x 4 in.



DOUBLE-WEDGE PRINCIPLE is basis of hardware design

Tests on the assembled wood members showed a failure strength of 12,000 lb. in the direction of the conductor. Failure was by buckling of the near leg. By modification of design any reasonable strength may be secured.

The hardware developed for both ends of the wood members works on a double wedge principle. The wood is placed under compression at the point of attachment for both tension and compression forces on the arm. This arrangement increases the strength of the assembly very materially and will maintain it with any shrinking or swelling of the wood.

In addition, the outage time on our transmission system, due to painting, averages about 18 per cent of all maintenance outage time. With wood arms and galvanized malleable iron fittings, this outage would be eliminnated as the tower and basket could be painted while the lines are in service and with no need for the workmen to go outside of the tower basket.

Underline Ground Wire

Schemes C, D, and E all show the installation of a ground wire installed near the elevation of the lower phase wire.

For various reasons the extension of buried wires any appreciable distance from the tower base was considered objectionable. In addition, a study of the illustration on page 50 shows a reasonably low level of tower footing resistances, since 59 per cent of the towers are under 10 ohms. The

rest may be reduced to satisfactory values by either ground rods or moderately short (50-ft.) radial wires from the base of the towers to ground rods at the ends. The idea of a continuous buried counterpoise was therefore discarded.

A study of the usual practical design, equation (1) for a stroke to the tower shows that the *S* factor, or (1—C), enters the problem theoretically on an equal footing with *R*, yet most serious effort has been expended in contriving ways and means to reduce *R*, rather than in finding ways to increase the coupling factor.

$$(1-C)IR = E \text{ or } SIR = E \quad (1)$$

where C = coupling factor between conductor and ground wire.
$S = 1 - C$.
I = tower current.
R = tower footing resistance.
E = effective impulse strength of insulator string for wave shape impressed.

Since structural limitations made it necessary to seek proper shielding and midspan clearance by means of raising the present ground wire, the coupling factor fell somewhat below that for the old construction, or from 0.25 to 0.19.

In order to appreciate the desirability of giving suitable weight to this factor it should be noted that no differences in potential could occur across the insulator strings if the entire conductor system were inclosed by a metallic cylinder supported by the tower. The addition of any ground wire is equivalent to adding a segment of this theoretical cylinder.

The location of the upper ground wire was, of course, dictated by the need of adequate shielding and proper midspan clearances, while that of the lower one was determined as the location which would give the greatest increase in coupling factor.

As applied in schemes D and E, the addition of the underline ground wire raised the minimum coupling factor from 0.19 to 0.48. Applying these values in equation (1) indicates an increase in effective impulse strength of the tower insulation of about 56 percent. Economically, this increase is large as compared with the cost of attaining the same results by other methods.

We believe this design embodies the first extensive application of the underline ground wire as a deliberate design feature based on the direct stroke theory of preventive lightning protection and was suggested by E. B. Whitehead.

Performance calculations were made for all schemes shown. The chart on page 51 gives a comparison between schemes in terms of faults for one of the lines of the system. The expected outages are shown divided between faults due to strokes to conductor, or shielding failures, and faults due to strokes to ground wire or tower. This division was made due to the difficulty of an exact analysis of the first part, even though the values are believed to be quite accurate. This chart also indicates the relative costs of the rebuilding schemes.

A study of this chart, in connection with the details of the various schemes given before, reveals some very interesting facts. In schemes B and C, which were eliminated from consideration for mechanical and poor clearance reasons, the major improvement in performance is due largely to the reduction in the number of faults due to poor shielding, with some improvement due to better coupling and improved ground resistance values. In scheme D the shielding is not estimated to be quite as good as in schemes B or C, but the calculated performance due to strokes to the tower or ground wire system is much better because of improved midspan clearances, good coupling and good ground resistance values. Another advantage of scheme D is that it can readily be changed to scheme E at some later time merely by the addition of the wood arms. The performance of scheme E is improved over scheme D through the direct increase in insulation afforded by the use of wood arms.

On the basis of these facts, scheme D or E will be employed on any rebuilding work. The choice between them will depend on the importance of the lines to the system and on experience which will be gained on the first ones.

The lines rebuilt this past year were in accordance with scheme E as they are vital links to the system and the utmost in performance was desired. It is expected that it will be impossible to get these lines out of service for further work at some later time. All pictures shown illustrate the construction on these lines. Another line may be rebuilt this year in accordance with scheme D, which will allow the questions of shielding and coupling to be studied further.

Distribution Losses Are Reducible

[*Continued from page 49*]

previously included in the city system were transferred to a co-operative which has since taken wholesale supply at the city substation.

Beginning in 1936 and extending over a period of three years, all the electric meters were removed from customers' residences and most business places and put in outdoor meter boxes on poles. This last move has made the most radical decrease in distribution losses. A majority of the older meters were replaced with new meters of modern characteristics. Few of these are of the socket type.

With transformer core losses taken as 6 watts per kva. and 3,000 kva. installed, transformed iron losses for 1938 amount to 155,500 kw.-hr. consumed, and with meter core losses at 1 watt per coil and 2,500 coils the total iron losses come to about 175,000 kw.-hr. As 400,500 kw.-hr. was total loss in 1938, we have 225,000 kw.-hr. for copper and other losses.

In 1940 with transformer and meter core losses about 200,000 kw.-hr. and total losses 375,500 kw.-hr., we find copper and other losses about 175,500 kw.-hr. High and low voltage leakage to ground is small and theft is small. These figures would indicate that copper and iron losses in the system are very nearly equal. We have allowed very little for underregistration of meters as all meters have been tested as they were moved.

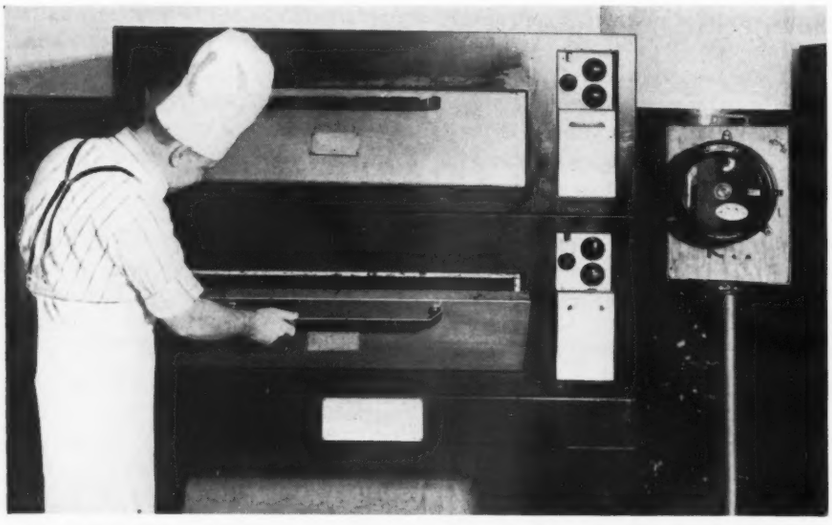
Increase in losses in 1940 over 1939 is due to transfer of REA load to a rural generating station. Losses in 1941 will reach 5 to 6 percent unless the system is quickly changed over to 4,000-volt star operation. This is admittedly rather a small system to rebuild for 4,000-volt, four-wire, but it will be simple to change when substation sites are changed. A fair estimate of cost to change from delta to star is $5,000.

Residential street lighting has been mostly on a series basis, while the commercial district has been lighted on multiple, using the same transformers that supply commercial lights. Control is by clocks.

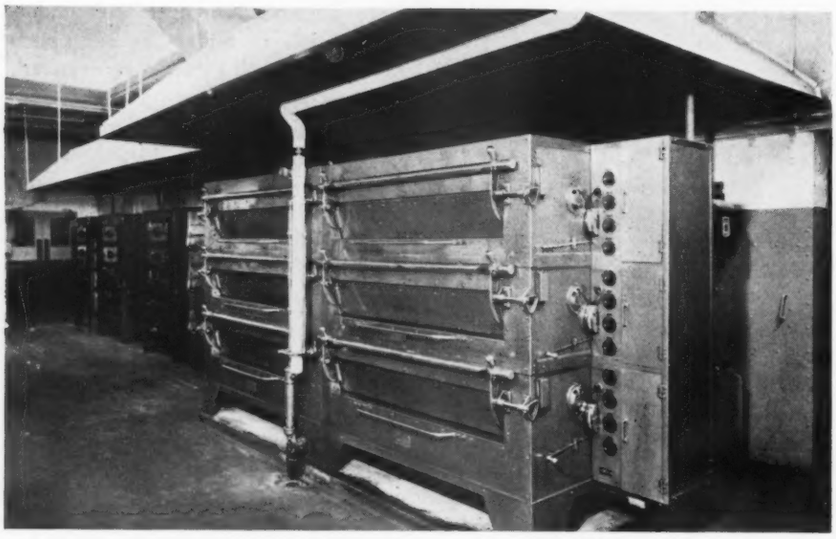
Commercial Cooking Program Yields 2,000 Kw. Annually

Commonwealth Edison draws upon 24 years' experience — Utility advertising, promotion and service build up repeat business based on long-pull customer satisfaction

O. R. HOGUE,* Commonwealth Edison Company, Chicago



ACCURATE DATA on operating costs—company now offering one month trial on heavy-duty equipment. Meter on pedestal (at right) provides data for actual operating costs



BATTERY of electric bake ovens at Marshall Field's—three new ovens in foreground; in background 23-year old veterans still in service

THE CONVICTION that commercial electric cooking offered a load-building opportunity came to the Commonwealth Edison Company many years ago, and since that conviction was acted upon early this business has experienced a slow but steady and satisfying growth in Chicago over the past quarter century. During the past two years, due to reorganization, increased advertising, rate modifications, inducement offers and added promotion, this growth has been accelerated, as witness 2,124 kw. in electric cooking devices added to our lines in 1940, as contrasted with 1,987 kw. in 1939.

From our surveys and experience, dating back many years, we have concluded that the potential market for electrical cooking load in Chicago is both large and attractive enough to warrant the special inducements we have offered to promote it. The character of this load is such that the peak demand occurs before either the commercial load peak or the system peak, and there is, consequently, very little additional distribution expense required to take on this load.

Pioneering in 1917

In 1917 America was conserving food, and many male Americans, if they thought of cooking food at all, thought of beans cooked over an army stove. Those in charge of food service at Marshall Field's retail store were thinking of cooking, too, but in another way. They were thinking of using electricity as a fuel in ranges and bake ovens.

*Manager lighting and wiring sales.

In those days such thinking was audacious, almost heretical, yet their thinking was straight and courageous, and their conclusions were backed with action—action that resulted in the installation of four electric ranges and two combination baking and meat roasting ovens in their employees' kitchen and five electric ovens in their bake shop.

Still Going Strong

The years rolled by, ten, another ten and three. In this near quarter century interval Field's 1917 electric ranges and bake ovens saw strenuous daily exacting service. In terms of the life expectancy of flame fuel equipment they had lived their useful span twice over and were still going strong. Going strong in part is perhaps a more exact description, for it was to be admitted that after twenty years the ranges and four of the seven ovens were beginning to show signs of senility, but the remaining three ovens in the bake shop still had more years of useful service in them.

So it was that in 1940, when the food thoughts of younger male Americans again turned to army beans, Field's again turned theirs to electric cooking. Again a decision was to be made on fuel type. All evidence pointed to electricity, but this time it was evidence based on years of first-hand experience. Experience that spoke well of the economy, the high satisfaction, the superior results and the long equipment life of electrical cooking. This evidence was accepted and Field's determined to continue cooking electrically.

Five New Ovens

In the employees' kitchen five new ranges replaced the four old, two new ovens replaced the two veterans and two fry kettles and a broiler on oven base were added. In the bake shop two new ovens retired two, three continue in service and one was added. Such is the saga of Field's pioneering in electric cooking.

Nor is it to be concluded that the Field experience with electric cooking is unique in Chicago, for that of the Belden Stratford Hotel is almost an exact counterpart. Seventeen years ago this organization installed an electric kitchen for preparing all meals served in the dining rooms. In 1910, after seventeen years of exacting daily service, this old installation was replaced with modern electrical equipment. But again only a partial replacement was necessary, for the old electric bake ovens were still serviceable. The experiences of these two Chicago pioneers gives needed and helpful local testimony that electric cooking is economical, trouble free, satisfactory, and that the equipment is exceptionally long lived.

The management of Field's might have conceived of the idea and adopted electric cooking 23 years ago without help and encouragement from an electric company, but the Commonwealth Edison Company gave such help and encouragement, and accordingly prefers to name that instance as the beginning of its promotion of electric cooking.

Ranges Added

This promotion was carried forward by a small group of specialists assigned to the power sales department of the company. Over the years they have been active and successful in the electric cooking field, carrying the story of heavy-duty equipment to the company's larger users of electric energy. Their work resulted in many hospitals, clubs and hotels in Chicago adopting electric ovens for baking or roasting, or both, so that today more than 150 electric ovens are in service, with a total connected load of more than 2,550 kw. Some of these installations are also using electric ranges and broilers having a total additional connected load of about 1,000 kw. Important among the names on the Chicago list of heavy-duty electric cooking equipment users are the Edgewater Beach Hotel, the Palmer House, the Union League Club and Pixley & Ehlers.

During the time that heavy-duty equipment was being brought into service among the large users of energy by the power group of the Commonwealth Edison Company, electric counter-cooking devices were being just as aggressively and successfully promoted among the company's retail commercial customers by the lighting sales department. In this field experience again proved, as it had with heavy-duty equipment, that specialization brought greatest returns. Accordingly, a small group directed their entire efforts to the promotion of counter-cooking devices. These men found that many sales could be secured through demonstration in the customer's place of business, and they were permitted to use this method extensively.

While satisfactory progress was being made in securing both heavy-duty and counter appliance business under the dual arrangement previously described, it was concluded that greater success would be enjoyed if the two separate activities were consolidated. Accordingly, in December, 1938, these two groups were combined into a commercial cooking division. As a result six men now devote their entire efforts to a definite program of promoting electric cooking in its entirety to all customers engaged in the food service business. The personnel, coming in part from the older heavy-duty group and in part from the older counter appliance organization, brought with them into this new division the experience, the complete knowledge of equipment and operating characteristics and the peculiarities of the food service industry, all of which is essential

[*Continued on page 116*]

After 17 years of proved performance
ELECTRIC COOKING WINS AGAIN
at the Belden Stratford Hotel
COMMONWEALTH EDISON COMPANY

SEVENTEEN YEARS EXPERIENCE—Commonwealth Edison capitalizes on long-term experience with commercial (and apartment-kitchen) electric cooking

Engineers Prepare for Emergency Conditions

E.E.I. engineering committees take up speedy cable jointing, efficacy of capacitors in postponing additions, performance of service restorers, limitations of motor starting currents, heating of power station cables, metering standards and safety precautions

Reported by A. E. KNOWLTON and D. T. BRAYMER

IMMINENCE of war emergencies was coupled with determined effort to promote equipment standardization and to ferret out operation troubles to give significance to the discussions at the engineering committee meetings of the Edison Electric Institute in Chicago, May 5 to 9. The sessions were well attended and relatively little affected by withdrawal of a few active members. Busyness of the times was reflected in proposals to lengthen the intervals between preparations of reports on continuing matters.

The prime movers and electrical equipment committees held closed sessions, but the others were generally open discussions, which are reported here, with predominance, therefore, of matters arising with the large transmission and distribution committee. Outstanding in those sessions were presentations on cable joint compounds, cable loadings, limitation of motor-starting currents, performance of capacitors and restoring fuses and switches, corrosion of transformer tanks and radio-proof insulators.

Report of progress in a study of cold-setting compounds for temporary cable joints by L. I. Komives (Detroit Edison) indicated that expansion, dielectric strength, effect of alternate heating and cooling, and combustibility are being covered. Certain materials in the tests have already withstood ten times normal voltage. Two asphalts and a lime solution solidify when mixed and no hand wrapping is required in one experimental form.

The British have dropped interest in cold-setting joint compounds, said R. J. Wiseman (Okonite) because a water main is usually disrupted when the cable is and none of the cold-sets are proof against moisture.

Data from nineteen companies on 15,128 miles of cable for the periodic cable-operation report is in the hands of the E.E.I. headquarters staff, but the analysis and compilation are reported delayed by recent staff curtailments.

Styrene Joints

Partial success with hot-process application of styrene in cable joints and terminals has been followed by an effective cold-process technic, said T. R. Scott of Standard Telephones & Cables, Ltd. Durable joints are now being made by extrusion of plasticized semi-polymerized styrene from a factory-made cartridge into the joint from which it expels a liquid monomeric styrene. This avoids voids and averts the shrinkage of some 15 percent incurred when hot liquid styrene was poured into the joint and expected to polymerize and solidify.

Contrasted with British practice, American cables are metal-sheathed and of larger conductors; both tend to carry away the heat and prolong the polymeric hardening, said R. J. Wiseman (Okonite), who commended the new cold process, as did G. B. Shanklin (G. E.). W. A. Delmar (Habirshaw) saw in styrene the potentiality for a small-sized joint and maybe a smaller manhole. K. S. Wyatt (Phelps-Dodge) said it was now excellent for stop joints and ultimately will win favor for all joints.

Wartime damage to cables in Britain has been far less than was anticipated, said K. S. Wyatt (until recently with Enfield Cable). Outages have been infrequent and of rela-

Brent Mills, Lapp Insulator; Frank Frable, W. N. Matthews Corp.; J. A. Keeth, Kansas City Power & Light; Lee Ruff, Nebraska Power; C. W. Mayott, Connecticut Valley Power Exchange, and W. T. Pavely, Cincinnati Gas & Electric

M. R. Gowing, Ohio Brass; L. P. Works, Wisconsin Public Service; C. J. Miller and G. L. McCreery, Ohio Brass; D. I. Bohn, Aluminum Company of America; F. E. Fairman, General Electric; H. W. Eales, Public Utility Engineering & Service; F. W. Cramer, Carnegie Illinois Steel

tively short duration. Before the war comprehensive preparations were made for emergency joints requiring no flame, simple technic and simple materials. Trials revealed large shrinkage and, in general, more operating trouble with emergency joints than by bombing of permanent joints. One crater was 35 ft. deep and 65 wide; the cable was rerouted. Cables are often stretched so much by bombing that slack has to be cut out, but they test out all right, just the same. A 5-in. pipe with 0.167-in. wall carrying a gas-pressure cable was bent and dented, but it stayed tight and the cable carried the load.

Capacitor Performance

Failure rate in 1940 among 139,400 kva. of capacitors on sixteen systems was found by M. C. Miller (Ebasco Services) to be 0.6 per cent. Defective materials, workmanship or design accounted for failure of 20 units (0.2 percent); of these seven were gas-filled units. Lightning caused seventeen failures and nine of these were on one system having 15,460 kva. Economy of lightning protection is, however, inconclusive, the data indicating that there was about the same rate of failure for protected and unprotected units.

Theodore Seely said his system (Public Service Electric & Gas) now has 47,170 kva. and will have 53,110 kva. by the end of 1941, and all will have standard lightning protection ($25 factor in $1,230 for a 180-kva. installation). Three-fourths the cost of capacitors is justified solely by reduction in losses. Many installations made to postpone additional system facilities are not moved when the load increases. In order to prevent rise of transmission voltage at light load it appears that more automatic switching of capacitors will become advantageous. No resonance trouble has been experienced. A St. Louis speaker said seven of his eighteen gas-filled units have failed.

No reason exists now for not feeling that capacitors can continue to be supplied, said D. K. Blake (General Electric), although the aluminum situation is less reassuring than steel, paper, or Pyranol. Purchasers could well mention a defense angle when ordering. He favors 15-kva. units in combination over three-phase assemblies.

Separate capacitors up to two or two and a half times the kva. rating of ROC street-lighting transformers have had to be applied to reduce the voltage dip, said Seely, because the internal capacitor does not do the job.

Since last December a joint E.E.I.-N.E.M.A. committee has been studying limitation of starting current per horsepower for small single-phase motors. At first the utility groups urged 15 amp. against the manufacturers' desire for 30, distribution cost data indicating that design would have to be for 100 percent range saturation to permit general application of frequently started motors at 30-amp. starting current.

The committee has now agreed on the following values of maximum permissible locked rotor amperes for single-phase motors (with qualifications) for incorporation in utility service rules:

	115 Volt	230 Volt
Frequently started—automatically controlled	20	25
Infrequently started — manually controlled	40	50

The qualifications are that (a) a tolerance of not to exceed 10 percent will be permitted and (b) values in excess will be referred to the utility company when motor applications arise.

Comprehensive data about some 609 reclosing fuses and 67 reclosing switches on nineteen and eleven companies respectively was reported by

T. G. Hieronymus and C. C. Cornelius, Kansas City Power & Light; C. E. Arvidson, Commonwealth & Southern; H. P. Seelye, Detroit Edison; A. E. Silver, Ebasco Services, and A. E. Davison, Hydro-Electric Power Commission of Ontario

C. V. Waddington of Kansas Gas & Electric. Discordant and incomplete records somewhat vitiate his conclusions, he admitted, but he felt he could say that switches develop less defects in operation than fuses and also restore service in a higher percentage of cases, when compared on the basis of 100 miles of line. Out of 59 faults per 100 miles of line the fuses restored service in 65 percent of the cases. Switches were called on to isolate 151.5 faults per 100 miles and successfully restored service in 92 percent of the instances. Fuse lockouts and failures were 8.1 and 0.36 percent per 100 miles.

Waddington was joined by D. K. Blake in a plea for more complete and uniform data so that the art can emerge more positively from the present manifestly experimental stage.

Non-Inflammable Liquids

On experience with non-inflammable liquid-filled transformers reports were received from 100 companies having 1,116 units totaling 421,799 kva., with about four out of five in network or auto-transformer service. There were six failures in 1939, and of the 28 since 1932 thirteen occurred on test. In general the failure rate of 0.551 per year per 100 equivalent three-phase banks is practically identical with recent oil-filled transformers. Moisture, said M. W. Ghen, in presenting the report, affects the oil dielectric strength much less than the non-inflammables. No failures from pothead contamination were reported. Oil-filled designs of conventional pattern are not convertible to non-inflammable liquid operation, it was asserted.

Utilization Voltage

Recommendations (based on letter ballot of the transmission and distribution committee) to the electrical equipment committee for voltage spreads for setting up utilization equipment standards for single-phase residential applications were reported by C. E. Arvidson (Commonwealth & Southern) as follows:

	Momentary Minimum	Minimum	Maximum
Maximum Spread	90	107	127
Preferred spread	90	110	125

W. R. Bullard (Ebasco Service) pleaded that more consideration be accorded the future consequences of crystallizing present conditions in the face of an unmistakable trend toward 120 volts; he wants to see more than 2 volts added to the prevailing median value and proposed 110–130 volts for maximum spread and 112–118 for preferred as more in keeping with future probabilities.

Cable Temperatures

Extensive tests on 500,000-cir.mil, 600-volt power house cables were reported by C. H. Moore and N. R. Patton of Columbia Engineering as carried out in Millers Ford station of Dayton Power & Light. Values of current to give stable copper temperatures of 85 C. to cables in open air, in open pans and in iron duct were generally higher than the IPCEA published values. The cable manufacturer's engineers were disposed to question the inclusion of all factors; in particular, it was suggested that occasional vertical runs would lower permissible currents in horizontal section. In open air it was found that cables one diameter apart will carry more than single cables because of the chimney effect, which even is accentuated up to two or three layers. A flat black paint reduced the temperature 10.6 C. below the 85 C. for a bright sheath or armor, thus indicating 12 percent increase in current-carrying capacity.

Exposed 4-in. iron ducts showed 415 amp. for single-loaded duct and 380 and 385 amp. for six in two layers of three and three layers of two respectively.

Cable at center of open pan carried 520 amp., but only 470 at the edge because of restricted circulation. Group reduction factors of 0.97, 0.925, 0.90 and 0.88 were found for two, four, six and eight cables symmetrically placed in open pans.

One general conclusion drawn by the authors was that published tables appear to give a very liberal margin of safety for heavy-duty low-voltage transformer leads and bus-ties.

G. B. Shanklin (General Electric) felt that IPCEA values are valid if all the variables are recognized, also calling attention to the fact that they pertain to braided cable and not the metallic armor cable used at Millers Ford. Further, they pertain equally to underground cables where conditions are usually even less favorable than in a high-pressure, high-temperature generating station such as precipitated the tests. R. J. Wiseman of Okonite stated that IPCEA will have tests made shortly on the conduit temperatures of loaded cables. The present data are admittedly conservative. W. A. Del Mar (Habirshaw) said dust accumulation in pans was a good reason for using conservative design values. L. F. Hickernell (Anaconda) said vertical risers also call for conservative current values.

M. W. Ghen (Duquesne Light) said tests in the field to ascertain the degree of possibility of increased cable ratings for emergency loading were awaiting warmer ground temperatures. Tests will also be made of movement in manholes.

Codes and Specifications

Progress in revising specifications for line hardware items was reported by E. H. Kendall of Commonwealth & Southern. New specifications for anchor rods, guy hooks, guy thimbles, pole steps, etc., have been submitted to manufacturers for comment. Considerable variation in strength of single-tube splicing sleeves has been found and attributed to too long or too high heat in annealing. Physical elongation or torsion tests will be incorporated in specifications.

A plea was made by W. McLean of Baltimore that the new crossarm

F. E. Davis, Consumers Power Company; R. W. Wilbraham, United Engineers & Constructors; Alexander Maxwell E.E.I.; J. A. Cheverton, Wisconsin Electric Power; George Cady, Okonite, and C. D. Brown, Wisconsin Electric Power

specifications be given a trial, even though it may cost more, as believed by some. A. H. Vorum of Standard Crossarm & Conduit said there would have to be progressive resort to structural grades of timber for arms. He said the new TD-61 results in a lower cost than the old N.E.L.A. specifications.

Former dissenting votes on Part II of the National Electrical Safety Code had been reversed following analysis of reasons for the negative votes and certain compromise arrangements. The code is now ready to go to the printer, added A. B. Campbell of E.E.I. staff, with likelihood of ratification by A.S.A. in about six months. (Significant changes in the code will be treated in a forthcoming issue of ELECTRICAL WORLD.)

"Editorial changes" in the new standard for distribution fuses by N.E.M.A. may, on analysis, prove to be more than editorial in import, said C. C. Cornelius (Kansas City Power & Light) and after further review by the joint E.E.I.-N.E.M.A. committee the standard will be ready for distribution.

G. E. Dean (Newark) said groups had been set up to canvas the insulator specifications, particularly the matter of pinholes for both glass and porcelain, with careful effort to avoid any embarrassment of current practice while shaping a standard.

Conducting Glaze

Demonstration of the efficacy of under-glaze conducting film in minimizing insulator radio interference was given by C. J. Miller and G. L. McCreery of Ohio Brass. After enumerating a multitude of hardware and equipment sources of noise and pointing out the limitations of conductive paints, metal, coatings and cemented metal parts, Miller showed that conducting glaze was an effective way of reducing overstress in air near the conductor or tie-wire and throwing the concentration into the porcelain, which can take it. McCreery said that flashover does not destroy the under-glaze conduction nor does accelerated weathering, whereas surface coatings are more vulnerable to both processes. The outer non-conducting glaze has to be controlled between 0.01 and 0.015 in. to insure contact of tie-wire with the conducting glaze.

Col. H. S. Bennion

No material has been found, said J. A. TenBrook (Philadelphia Electric) which will assuredly stand up for more than two years as a coating on subway transformer tanks for a corrosion preventive. A five-year life is desired. A DuPont acid and alkali resisting type looks promising, as does Lithcote, a bakelite resin with thermoplastic heat hardening, which is also resembled by a recent General Electric bakelite. A 9-mil zinc covering was applied to some tanks by the Schori process and followed by two sprays of rubber; results are inconclusive. Enamel application by Pfaudler Company of Rochester has proved satisfactory from an operating standpoint, but spalling of the enamel occurs readily under stress.

In discussion G. E. Dean said Public Service Electric & Gas was developing an inexpensive combination of auto-transformer and rectifier for cathodic protection. Another company reported bad corrosion on the tanks of 150 temporarily inactive street-lighting tanks.

Report on low-voltage a.c. network will be prepared this year from data already collected, and it was also decided to include systems of less than 15,000 kva. because these new installations largely represent the current departures in practice.

Meters

Opinions of five principal meter manufacturers read at the open session of the meter committee, Monday morning, indicates little likelihood of current aluminum, nickel or cobalt shortages seriously affecting watt-hour meter production this year if inventory buying is not excessive. Substitution of copper for aluminum in watt-hour meter disks is being studied by producers. Nickel and cobalt for "Alnico" meter magnets and temperature compensating elements will probably continue to be available in 1942. Belief was expressed that the aluminum situation would be somewhat relieved in the fall of 1941 by increased production capacity now in process of addition.

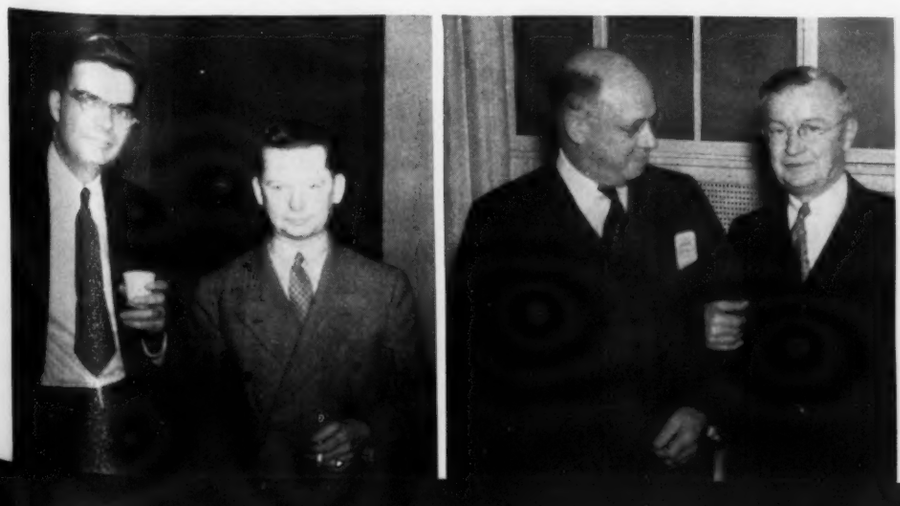
Some utilities are taking steps to build up a backlog of old meters which can be rebuilt for emergency use to avoid the extreme eventuality of unmetered service.

Transformers

Distribution transformer standards for 37½ to 100 kva. sizes were voted upon and approved by the transmission and distribution committee for submission to the proper N.E.M.A. group for consideration. In sizes 37½ kva. to 50 kva. for voltages of 5 kv. and below standard transformers will be without taps, but transformers with taps will be available for those who require it. Basic transformers

[*Continued on page 117*]

Lee Clark and F. D. Campbell, Detroit Edison; F. S. Brown, Duquesne Light, and H. B. Wood, Stone & Webster



Editorials

S. B. WILLIAMS, *Editor*

The Public Always Gets What It Thinks It Wants

A NEW STRATEGY in the battle of public vs. private ownership is offered out in the Northwest by the president of the Portland General Electric Company. He has seen private utilities fall back on a wide front, still using, against the heavy fast-moving armament of modern economic and social warfare, the same old threadbare arguments that have been employed for years. He proposes the use of the enemy's weapons.

So far the battle has been uneven because the two sides were selling the public a different service, but the public thought it was the same thing. Naturally the lower price offered by the public ownership fellows has an appeal. Chain stores have used that philosophy for years. The independents have been able to get higher prices from those who wanted the superior service, but the general public was more interested in price.

And so it is proposed that private utilities offer the public the same kind of service as public ownership offers and at prices as low or lower. Strip the service of all unnecessary items and where an expensive service is required charge for it.

It is pointed out that municipalities that purchase power from federal projects use surcharged rates, so the recommendation is made that private companies use zoned rates.

Whether this works out entirely as suggested remains to be seen. It is nevertheless a suggestion that cannot lightly be waved aside, because there have grown up in the utility business a great many things that separately cannot be sold to the public. Some, like free lamp renewals, have almost entirely disappeared, but others remain. Among them are: a high degree of continuity of service; free service connection; free appliance repairs and service restoration; firm power reserve that does not depend upon sufficiency of water at all times; extra precautionary patrols and maintenance schedules; modern bookkeeping; courteous collections; branch office facilities; night collections; accurate metering.

All of these have been developed to improve customer service. They all cost money. Can they be sold to the public? Undoubtedly the public would miss them and would complain if they were discontinued, but will the public be willing knowingly to pay the difference? Has anybody made an honest effort to find out?

There is one thing to remember. The public always gets what it thinks it wants.

The Power that Protects Our Standard of Living

POWER that ten years ago was criticized as robbing workers of their very existence by throwing men out of work through mechanization is their assurance today of the right to live decently as free men.

Industrial workers now have back of them twice as much power as they did during the previous world war. That in itself is the big assuring factor in our struggle to produce the immense quantities of needed defense materials.

In 1914 the average power at the disposal of each industrial worker was 3.2 hp.; in 1939 it was 6.5 hp. These figures, derived from the data contained in the Census of Manufactures power report for 1939, digested in this issue, are evidence of the tremendous strides electricity has been making in serving industry during the past quarter of a century.

Without this tremendous expansion in power application this country could not hope to compete with Europe in any armament or war preparations race. Therefore, it basically is the thing that preserves our American way of living. Furthermore, without this industrial power expansion there could be no five-day, 40-hour week. There could not be the greatly increased pay envelope of labor.

Power, in other words, is not only the backbone of our defense, it is the one thing that makes our standard of living the highest in the world.

In the twenty years that intervened since the close of the last war this big gain in industrial power has to a considerable degree been made possible by the low-priced, flexible, always available central station service supplied by utilities. Of the growth in that period approximately 70 percent went to purchased power. Would the growth have been as large if individual manufacturers had had to invest in power generating equipment as well as motors?

And as we view these rapidly rising figures of power usage we cannot help wonder what the results will be at the end of this decade. With the number of workers available approximately the same, for population is increasing very slowly, and with available power larger

still, does it mean further reduction in hours and higher rates of pay? Does it mean that goods will be produced for less money in order to keep industrial investment busy?

If it does it means that the American standard of living will survive even the envisioned hundred-billion dollar national debt.

Watch Styrene Development

STYRENE, a benzine type derivative of coal tar, with a remarkably favorable combination of electrical, mechanical and thermal properties, bids fair to play an important role in cable development. The British have steadily improved the technique of applying it to cable joints, while cable manufacturers here have been following the movement, in some cases with active experimentation, and a few of the larger utilities have been trying it out cautiously.

The product is available here from several sources. It has other uses than for cable, and once again the cable art, which relies very largely for its materials upon the progress of non-cable uses, can hope to profit by the prospective reduction from the present high cost of the material. Meanwhile, the stability and purity of the liquid monomeric form will undoubtedly improve, as will the rate at which the transition to the solid polymer can be made to take place.

Delaying influences seem not to have deterred the British; in fact, it has been stated that the over-all cost of a completed joint is not only competitive but that the procedure is fast enough to meet the wartime requirements of speed and simplicity. A cartridge of plasticized material is made up at the factory and its contents are forced into the joint to replace the liquid form with which the joint is first filled, and the whole joint can be done in about two hours ready for immediate energizing.

On the whole, the insoluble filling compounds used here in making up joints and terminals while admittedly not a perfect answer have steadily improved joint performance, and there is little likelihood of any stampede to such an alternative technique. Nevertheless the sympathetic reception of the British experience by American cable engineers indicates that there is a degree of interest which can be expected to expand. This is the procedure which evolved from an effort to perfect a technique which could produce a good joint quickly without heat application and with less careful workmanship — all measures that are dictated by war conditions. Prior efforts to pour in liquid styrene and wait for the polymerization were of dubious success, even after injecting inhibitors and stabilizers to control the transition to solid state. But the cartridge is filled with styrene which is better than 95 percent polymerized — well along toward full solidification—yet plastic enough to be extrudable and nook-and-cranny-filling.

Association for Service

IT IS a common human failing not to appreciate the value of a thing one has always had until it is lost or is about to disappear. It might be a home or a fortune or a business or a friend. In the case of an association few members, others than officers and committees, give it any thought from one year's end to the next, unless they need some help. But let something happen to hurt the association's effectiveness, or perhaps destroy it, and the members begin to realize their delinquency in not doing their part to preserve the well-being of the organization.

From this angle the recent cloud thrown over utility associations by the SEC interpretation of Section 13-f of the utility act may have had a silver lining. Certainly more people are seriously concerned over the future of these associations than previously. More people realize how very much alone they will be without some unifying force, no matter how limited it may be.

So far only the sense of possible impending loss and how to prevent it have been the gist of general discussion. It seems to us, however, that this is a good time to evaluate the work of associations, to regain an appreciation of their contributions to an improved electric service, to get a picture of what they are doing, to realize how dependent the industry is upon their interrelated work.

For that reason we are devoting our May 31 issue, the one just preceding the annual convention of the Edison Electric Institute, to the subject of Association for Service.

The industry is proud of its electric service achievements. What have been the contributions that came from the association of men? One has to stop and analyze to get any appreciation at all.

The issue will not be the story of any association, nor will it be a complete story of all associations. It will be a simple appreciation of the results that come from men working together, with just enough detail to prove the case.

It is presented at this time to help men understand that as America is great because people worked together to build it, so electric service is universal, reliable, economical, safe and satisfactory because the progressive ideas of the one were shared with the many, because men worked together for the common good. This is Association for Service.

Congress Might Balk at St. Lawrence

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

IT'S MUCH too soon to be sure, but there is certainly a possibility that the St. Lawrence seaway may be pigeonholed until after the war, though it may be revived with renewed force then as a public works project to provide employment.

President Roosevelt rarely changes his mind, gives up an obsession, forgives an enemy, but some of his advisers are giving him the most discouraging reports about what would happen while this measure was running the gauntlet in the House and Senate.

The average senator and member of the House likes to think of himself as important in the government. He likes also to think of Congress as a whole as a vital and responsible element in our scheme of things. Actually, he acts day after day and week after week as though he had no such conviction. He votes as the leaders tell him, whether he be Democrat or Republican. Nine times out of ten, perhaps 49 times out of 50, he "conforms."

Can Be Pushed Just So Far

But there comes a time when he feels that he simply must insurge, if for no other reason than to show himself, as well as his constituents, that he, as well as the Roosevelt Brain Trust, is doing some thinking on his country's behalf in these dangerous times.

He is usually not any too brave about it. He seldom picks the issue on which to demonstrate his own importance unless he finds there is at least a division of sentiment about this particular issue back home in his district or state.

How this works out is perfectly illustrated in the Supreme Court fight. It took a long time to convince a good many congressmen that they would not be committing political suicide if they opposed the President on this issue. But once they found that a goodly percentage of the newspapers read by their constituents were opposed to the bill, and that they were getting a lot of mail from people they knew back home against it, they decided to demonstrate their own independence.

For a long time now there has been no such opportunity. It did not really occur on the various war measures, such as the lend-lease bill, because most members of both houses actually agreed with the national necessity there, and those who opposed had been in that camp for a long time.

So it just happens that the time is about right for a display of independence, now that the St. Lawrence seaway bill is in preparation. Had Congress really insurged on the national defense labor situation, as seemed probable for a time, it might have aided the President enormously on the St. Lawrence. Seldom does this need for registering independence boil over twice in quick succession unless the President is slipping, and there is not the slightest sign of that.

Is It Worth It?

The President is not convinced that the St. Lawrence bill could not be forced through. It is just a question of whether it is wise to pay the price that such forcing would entail. There has been a fairly active campaign back in the country to build up a backfire against it. The electric utilities, though vitally interested, have not attracted any attention by their efforts, if any, but the coal, railroad and Atlantic port interests have been very active indeed, and have done their best to line up the labor groups that would be affected with them.

These interests have always been strong enough, and active enough, to prevent the ratification by the Senate of any treaty including a seaway. They have had more than one-third of the senators with them since 1934. (It takes a two-thirds majority in the Senate to approve a treaty.) But this time they were threatened at once with the national defense label which the President pinned so adroitly on the seaway project, and with the plan of pushing it through as legislation, which would require only a majority vote in each house of Congress.

The President has believed from the moment he started his latest drive for the St. Lawrence seaway that he could muster this majority in both houses. But now his advisers are laying more stress on the danger from a filibuster in the Senate than that from an adverse majority.

Opposition Politically Safe

With considerably more than one-third of the senators strongly opposed to the plan cloture was impossible. It takes a two-thirds majority to impose cloture. So the forty-odd senators against the proposal could talk indefinitely. Also, unlike the situation when the lend-lease aid to Britain bill was up, they would not be risking as much. For instance, a senator might be strongly isolationist, but he would hesitate to delay indefinitely passage of the lend-lease bill, because to do so might permanently alienate many of his constituents to whom the bill was the most important thing in the world. A considerable number of people in his state, therefore, might be expected to vote against him at every opportunity for the rest of their lives, regardless of every other issue that might intervene.

No person believes that a senator who would filibuster against the St. Lawrence seaway would be guilty of treason, or would really be impairing the war effort. There is no evidence that the country has taken the national defense label on this project seriously.

So the Senate is set to insurge. But efforts to show that individual senators would not be running too much of a risk might prove helpful!

NEWS OF THE WEEK

More Capacity Planned by Pennsylvania Edison

President Werner says company will spend $3,250,000 to enlarge Williamsburg generating station — Will install two new boilers and 25,000-kw. turbo-generator — Extends transmission lines

Planning ahead to insure an abundance of electric power for customers in its territory, Pennsylvania Edison Co. proposes the expenditure of approximately $3,250,000 to improve and enlarge its steam-electric generating station at Williamsburg, Pa., according to E. H. Werner, president and general manager.

Mr. Werner said that directors have authorized him to proceed with the ordering of materials, equipment and machinery and to inaugurate engineering studies to enlarge and increase the capacity of the Williamsburg plant.

Prepares for Future

"Demand for electric energy during the past year has placed a tremendous burden upon the plant capacity of the company," Mr. Werner said, "and with the thought in mind of preparing for future needs, the Williamsburg plant will be enlarged as soon as possible."

The present generating capacity of the plant is 17,000 kw., consisting of three units of 4,000 kw., 5,000 kw. and 8,000 kw. It is planned to install a 25,000-kw. turbo-generator, which alone will cost approximately $600,000 and will require approximately two years for delivery from the manufacturer. It is hoped to have this unit in operation, as well as other improvements completed, by the fall of 1943.

It is estimated that nearly $575,000 will be spent enlarging the power plant building and other structures. More than $450,000 will be spent on boiler plant equipment, Mr. Werner said. There will be two boilers totaling 38,000 kw., 850 lb., 825 deg.

The auxiliary draft and feedwater equipment, stokers, grinders and hoppers, ash-handling equipment, water supply system, boiler piping, turbo piping, station electric equipment and miscellaneous power plant equipment will entail the expenditure of another $1,125,000.

Transmission Line

In addition to the Williamsburg plant improvements, Mr. Werner said, it is planned to rehabilitate and to add to the transmission line facilities leading from the plant so that the additional generating capacity at this point will be made available to the customers of the company throughout its system. The rehabilitation and addition to the transmission lines will involve the expenditure of nearly $350,000.

This will be the first major change in the plant since 1920. The plant was constructed and placed in operation in 1914 and was the first plant in the system. After the installation the system will have installed capacity of more than 100,000 kw. It serves 67,561 customers distributed in eleven counties and 4,500 square miles of central Pennsylvania, covering 295 communities and rural areas.

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Senator Aiken Sees Federal Utility Control

Senator George D. Aiken of Vermont forecast, in an address in New York last week, closing the three-day First National Town Hall Conference, that some form of state socialism would evolve under President Roosevelt's emergency powers.

"Unless I am guessing wrong," Governor Aiken said, "the federal government will own or control far more closely than heretofore the electric power, the transportation systems and the financial institutions of America. Greater federal control will be exercised over our rivers and other waters and over the land of the nation."

Crane Short Circuits Lines in Hartford

When a construction company crane short-circuited power lines of Hartford Electric Light Co. last week the break started a fire in a bus at the Dutch Point station, where energy from the South Meadows generator is distributed, and put the station temporarily out of commission.

The utility's Maple Avenue substation, fed from the Dutch Point station, was temporarily immobilized by the break in the lines, the third such short circuit in recent months.

Service was out for varying lengths of time, with most customers getting service in a few minutes.

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Public Power District Buys Utility Property

Consumers Public Power District of Columbus, Neb., has purchased the Nebraska Light & Power Co. plant serving McCook, Neb., for $444,000.

McCook, the home city of Senator George W. Norris, veteran advocate of public ownership of utilities, recently voted down a measure providing for a $444,000 bond issue for purchase of the properties.

PLANT ADDITION—Frank G. Boyce, vice-president of Consumers Power Co., turns the first shovel of dirt to start the new 50,000-kw. addition to the John C. Weadock electric generating plant on Saginaw Bay north of Bay City. Participating with Mr. Boyce in the ground-breaking ceremonies are (l. to r.) Louis G. Oberhauser, plant superintendent; Oscar M. Anderson, president of Bay City Chamber of Commerce; G. H. Conrad, division superintendent; Samuel Ball, division manager at Bay City; John DeWyse, Bay County supervisor; George F. Stecker, general construction superintendent; Dan W. Kimball, president of Owen-Ames-Kimball Co., contractors; Ambrose J. Maxwell, secretary of Bay City Chamber of Commerce; A. R. Hamilton, assistant general construction superintendent; L. N. Whitman, Bay City Chamber of Commerce, and Harold F. Mead, superintendent for the contractors

Olds Urges Building of Broad River Dams

Immediate construction of five hydroelectric power projects on the Broad River, north of Columbia, S. C., at an estimated cost of $80,000,000, has been urged by Leland Olds, chairman of the Federal Power Commission.

Mr. Olds said that the 220,000 kw. would be no more than enough to meet the minimum needs by the end of 1944.

The five projects suggested included Frost Shoals, 50,000 kw.; Lyles-Ford, 60,000 kw.; Great Lockhart, 60,000 kw.; Greater Gaston Shoals, 30,000 kw., and Clinchfield, 20,000 kw. The Clinchfield project is in North Carolina.

Gov. Burnet R. Maybank named a five-man committee to co-ordinate plans for development of the projects, including Tom B. Pearce, chairman of board for Santee-Cooper authority; P. D. Barron, Lyles-Ford; John Sloan, Buzzard's Roost; Monson Morris, president of the Aiken Rural Electric Co-operative, and D. W. Robinson of Columbia, former general counsel for the Federal Power Commission.

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Cited by New York Board

New York Public Service Commission has ordered the Central New York Power Corp. to suspend certain changes it filed relative to the rule governing increased loads of electricity to industrial customers. The changes proposed by the company would affect industrial consumers in the Oneida district, including the city of Oneida, villages of Canastota, Munnsville, Wampsville, Oneida Castle, Vernon and other towns in Oneida and Madison counties.

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Effect $420,000 Rate Cut

Federal Power Commission has announced that its rate order of June 11, 1940, has accomplished an annual reduction of about $420,000 in the interstate wholesale rate for electric energy generated by the Safe Harbor Water Power Corp.

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Adopts Tax on Utilities

The Clearwater, Fla., city commission has adopted a proposal for a 5 per cent tax on utilities as a means of raising an anticipated $33,000 to support its operating budget of $222,500. It was explained that the new utility tax was made necessary because anticipated revenues for the coming year are less than those of the previous fiscal period, and because of an increase in expenditures during 1941-42. Users of gas, water, electricity, fuel oil and telephone services will pay the tax.

NEWS BRIEFS

ALABAMA POWER CO. conducts a ten-day intensive training school in Birmingham for employees having some college training or practical electrical distribution experience in order to fill vacancies as they occur when experienced engineers are called in the national preparedness program.

THEFT OF STREET LIGHTS is the latest problem confronting the B. C. Electric Railway Co. at Vancouver. Over a two-day period ten complete suspended type street lamps were stolen in the South Vancouver section of the city. Power company investigators believe the thieves are salvaging the aluminum from the light fixtures.

CHARLES A. COFFIN FELLOWSHIPS have been awarded seven graduates of as many colleges and universities by General Electric Co. to enable graduates to continue or undertake research work in educational institutions either in this country or abroad. The awards were made in the electricity, physics and physical chemistry fields.

TO UTILIZE the "sour gas" supply in Arkansas, Carter Oil Co., subsidiary of Standard Oil Co. is to build a plant in the McKamie oil field in connection with the new 30,000-kw. generating station Arkansas Power & Light Co. proposed to construct as part of its $11,000,000 expansion program.

ONE-THIRD OF THE 1,300 residential customers of the Holden, (Mass.) town lighting department now cook electrically. Appliance sales are all handled by outside organizations, the department doing no merchandising. Capacitors aggregating 120 kva. have lately been installed to improve distribution voltage regulation and automatic line reclosers placed in service.

MERLIN H. AYLESWORTH, best known in utility circles as chairman of the Colorado Utilities Commission, executive vice-president of Utah Power & Light and managing director of N.E.L.A., has been appointed head of the radio section of the communications division of the office of the Co-ordinator of Commercial and Cultural Relations Between the American Republics under Nelson A. Rockefeller.

NESTOR A. TAKALA, 35, an inspector for the U. S. Bureau of Reclamation, was awarded the President's Medal from the National Safety Council at a public ceremony last Saturday for rapid rescue work, which saved the life of a man who had been buried alive in a sand hopper at Shasta Dam.

Clatsop County Rejects Public Power Proposal

Defeat of public utility district movement in Oregon considered significant, since area was fortified with support of Bonneville administration — Vote was 3,015 to 2,824

Although public ownership advocates received unlimited support from Bonneville, they failed to sway the voters in Clatsop County, Oregon, to go into the electric power business. When the votes were counted in the May 6 election the PUD proposal for the county was defeated 3,015 to 2,824 in one of the most significant elections in some time in the Pacific Northwest.

Five incorporated cities, Astoria, Seaside, Gearhart, Hammond and Warrenton, all returned "no" pluralities, while the rural areas favored the formation, but by insufficient margins to offset the negative votes from the towns. Under the Oregon law the PUD is killed, even for the rural areas, since the over-all vote was against the proposal.

Bonneville Support

Significance of the outcome is that public ownership forces concentrated on the county for nearly two months with the Bonneville Administration agents, including Dr. Carl Thompson and Morton Tompkins, who were especially active. Mr. Tompkins not only is on the Bonneville payroll, but is a state grange leader.

High points in the drive for public ownersip were the electrically transcribed talks on federal power by Dr. Paul Raver, Bonneville administrator. It was one of the hottest campaigns yet witnessed in Oregon and was conducted in an area well organized by co-operatives and has within its borders the Little Nehalem Valley Electric Co-operative Association, an REA setup which is using Bonneville exchange power provided by Pacific Power & Light Co., which serves the district.

Public ownership advocates counted heavily on the transmission line which Bonneville is building from Portland to Astoria to turn the tide. Pacific Power & Light is to distribute this power under a one-year contract. The utility has contracted to buy 1,500 kw. of Bonneville capacity.

Returns show the urban areas voted 2,102 yes to 2,564 no, while in rural territory the vote was 722 yes and 451 no. This was the first Pacific Northwest election since Spokane rejected municipal ownership last March after voting down a public utility district last November. Its defeat added another to the long list which has had a discouraging effect on the public ownership movement in the Columbia River territory.

Although the people in the Pacific Northwest have emphasized their dislike of Washington dictation of power questions in the territory, Secretary Ickes is having prepared a new Columbia River Power Authority bill which will give the Secretary of Interior control over all federal projects in the area and setting the policy of local units distributing Bonneville and Grand Coulee power. The PUDs have organized an association and gone on record as "demanding" home rule.

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Bodine Sees Act as Disintegration Move

Stockholders of the United Gas Improvement Co. were told at their annual meeting last week by President William W. Bodine that the utility act is being currently interpreted as an "anti-trust" or "disintegration" act, aimed at dissolution of bigness, of what is called "concentration of economic power," such as was advocated by many during the months of consideration of the legislation. Mr. Bodine said that Congress refused to pass such legislation and pass an integration and regulatory act.

In answer to a stockholder, Mr. Bodine said no one knows what may happen to U.G.I. and that it will be necessary to await the outcome of the present proceedings and maybe a court test to determine what the foundations are going to be and the company know upon what it can rebuild.

Mr. Bodine said that the company would put $7,000,000 of its proceeds from the Connecticut Light & Power sale into its Delaware system for the purpose of eliminating one intermediate holding company in the interest of corporate simplification.

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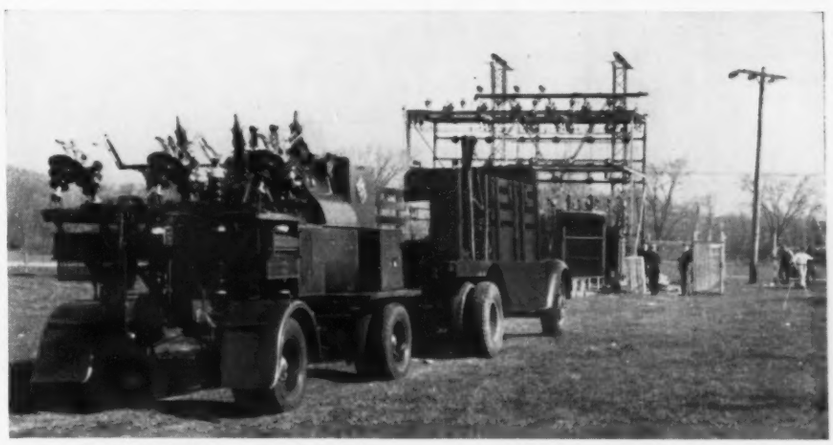
Syracuse Utility Puts Mobile Unit in Use

The new 1,000-kva. mobile substation, delivered early this year to Central New York Power Corp. for emergency and maintenance service in the Syracuse area, was hooked into the utility's system for the first time recently. Brighton Avenue substation was carrying an increasingly heavy load and shifting some of it to the Dorwin Avenue station was decided upon to relieve the situation.

Dorwin consisted of three 200-kva., 33-kv. delta transformers; Brighton is 33 kv.-4 kv. Before Dorwin could take over any of the load three 833-kva. transformers had to be put in, and the voltage of the substation changed from 2.3 kv. delta to 4 kv. wye.

During the ten days or two weeks needed to do this job the Dorwin station is killed completely and the mobile unit carries the load, which may go up to 500 kva.

The completely factory-built, self-contained unit is the first of its type. It was designed and manufactured by General Electric Co. See ELECTRICAL WORLD, January 25, 1941, page 52.



MOBILE SUBSTATION—Central New York Power Corp. put this General Electric mobile substation into service for the first time recently when a shifting of load from the Brighton substation to the Dorwin station was desired

'Quoddy Power Held Not Economical for Present

Federal Power Commission chief engineer reports tidal power cannot compete with present hydro and steam plants — Develops 17-project program in report to Senate

Tidal electric power at Passamaquoddy is sound from both an engineering and technical standpoint, but is economically unfeasible now or in the predictable future. Furthermore, there is no market for power from such a project at the price which would have to be charged in competition with available hydro development of Maine rivers or with steam generation at present fuel prices.

These conclusions are embodied in a detailed report of the famous New Deal project, once started and abandoned, made for the U. S. Senate by Roger B. McWhorter, chief engineer of the Federal Power Commission. The report is being printed as Senate Document No. 41, present session.

Harness Tides

Mr. McWhorter predicts the day will come when the tides will be harnessed in the Bay of Fundy area and recommends that detailed investigation of an international, rather than an all-American, project be made. Such a project, he believes, would fit into development of the area as a major naval base, which may be undertaken sooner than is now apparent.

Completion of the two-pool tidal and pumped storage project at Quoddy, the report estimates, would cost $87,854,000 if financed with government money at 3 per cent, or $90,776,000 if financed by private money at 5 per cent. Switchboard cost of power is set at 6.65 mills (exclusive of allowance for taxes and insurance as a government project, or 10.47 mills as a private one).

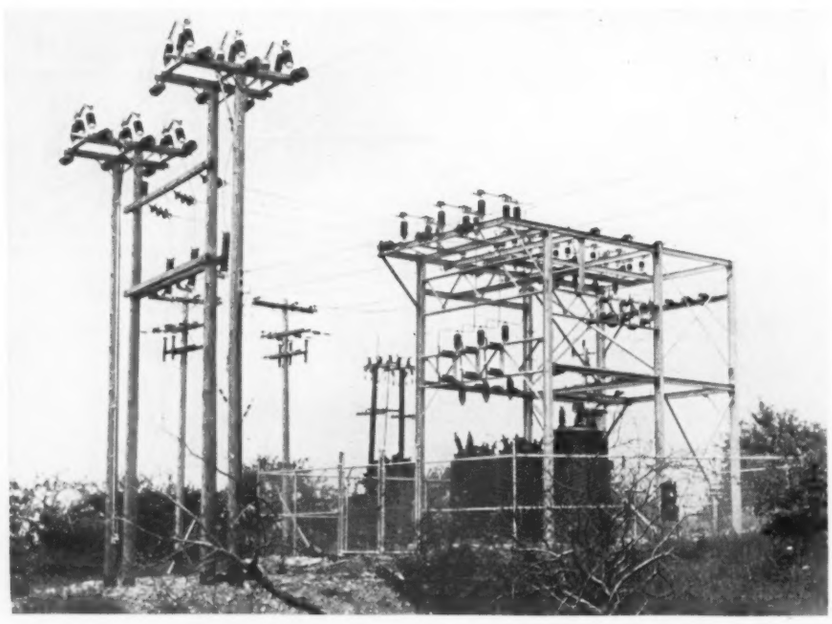
A completely comparable steam plant could be built for $14,891,000 with 3 per cent money and $15,180,000 with 5 per cent, to provide a kilowatt-hour switchboard cost of 4.49 mills in the former case, 5.57 mills in the latter.

17-Project Program

Although not requested in the Senate resolution asking for comparable data on a tidal and steam plant, Mr. McWhorter also develops in his report an elaborate 17-project hydro program costing an estimated $104,882,000 with 3 per cent money to provide power at 1.87 mills, or $107,336,000 at 5 per cent money, with power at 3.26 mills. Construction of part of this hydro program (roughly comparable to 'Quoddy) would cost an estimated $21,989,000 or $22,416,000, to provide energy at 2.36 mills or 3.86 mills.

Conclusions of the report are:

'Quoddy power cannot compete successfully at this time with river hydro or steam power; tidal power has "certain distinct advantages" over other sources in that it is thoroughly dependable and predictable and unaffected by weather; as high-grade fuel prices increase concurrently with expanding power markets in New England and contiguous Canadian territory, development of tidal power will become economically feasible and desirable; thorough exploration of the possibilities of a large international tidal power project should be made; undeveloped water powers of Maine "are clearly indicated" as the source from which large blocks of power should be obtained as needed in the immediate future.



SUBSTATION—Typical of several small substations which Rochester Gas & Electric Co. has erected to serve better the small rural communities in its service area

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Consider Higher Tax on Electricity Sales

Likelihood is being expressed in Congressional circles that the prevailing 3 per cent federal tax on electrical energy sold to residential and commercial customers will be increased in the new tax bill now being shaped. Discussion has not reached the point of fixing the amount of increase.

If the electricity tax is increased, a fight is certain over whether to add the levy to the present assessment upon the utility companies or to permit the companies to pass it along to consumers as was originally done with the present tax. The suggestion also will be advanced to extend the tax to public power sales, including the rapidly expanding federal output, but New Dealers will fight this to a finish. Public power is now exempt from this levy.

Neither the Treasury nor the House committee's tax experts formally included an increase in the kilowatt-hour levy in their original proposals, but the suggestion has been advanced informally and will get official consideration before a tax bill reaches the floor for debate.

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Need Rain in TVA Area

Unless heavy rains fall in the Tennessee Valley soon a severe drought in the area is likely this summer which will lessen hydro-electric production. February was the dryest since the TVA has been collecting records.

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Votes Municipal Plant

Voters of Graettinger, Iowa, recently approved a $100,000 bond issue for a municipal light and power plant.

Styrene Cable-Joint Perfected by British

Cable joints, formed simply by injecting plasticized styrene into high-voltage cable joints and letting it harden to form a complete insulating barrier or "voidless" filling, with a cost only a little greater than ordinary joints, have proved successful in Great Britain. They were described by T. R. Scott of Standard Telephones & Cables, Ltd. (London), at a recent meeting in New York of the power group, New York section, American Institute of Electrical Engineers. Styrene was shown to have a remarkably fortunate combination of electrical and mechanical properties for cable use.

After experience had been gained with making "hot process" styrenated joints, (120 deg. C. heat over a three-day period) the next step was the development of "cold process" joints, which eliminated the heat application.

Acetylated styrenated paper can be used successfully in the construction of bonded paper bushings and sleeves, either plain or in the condenser type with foil inserts.

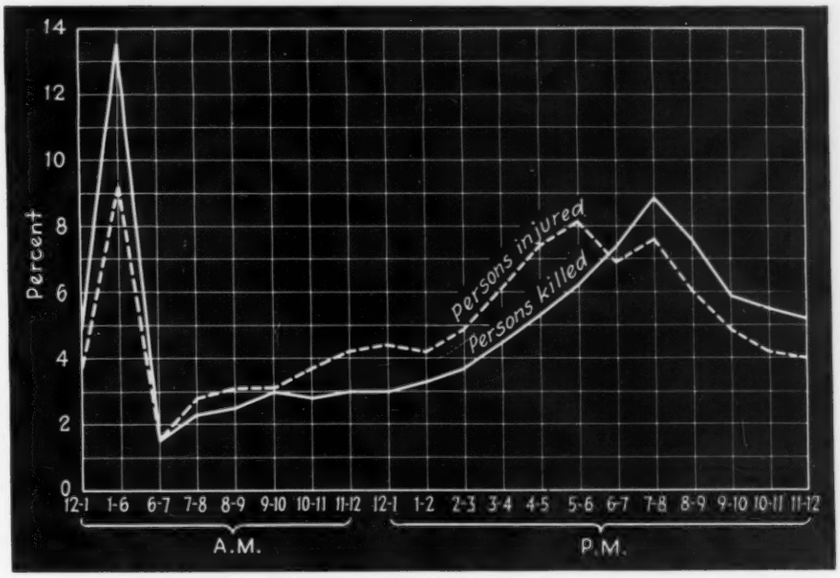
Factory-Made Joint

War conditions brought about a demand for a joint which can be made in the factory and assembled in the field. This consists in first filling the space between insulation and metal sleeve with monostyrene, which is displaced with plasticized polystyrene forced in under pressure from a sealed cartridge. The plasticizer chosen is one which does not involve undue softening at temperatures up to 100 deg. C., forms a mechanically adequate filling, provides a good insulant and adheres both to metal and to oil-impregnated paper.

This voidless filling technique has also been successfully applied to cable terminals and to condenser bushings and "condenser cones" for barrier terminals on cables, Mr. Scott reported.

Representatives of various American cable manufacturers supported Mr. Scott's development as a significant contribution to the art. The majority agreed that the technique may well have wide application and solve many cable joint problems for American utilities. It was pointed out that the joints illustrated by Mr. Scott had only slightly greater dimensions than the cables joined and that the plasticized filling obviates porosity of wiped joints. Earl R. Thomas (Consolidated Edison of New York) added that the characteristic of styrene to almost "fuse" with lead had appealed to his utility in sheath bonding practice.

Points in question raised in the discussion involved toxic effects of styrene, effects of concussion shocks on styrenated paper bushings, maximum operating temperatures possible with styrenated joints, whether styrene joints could be used to join rubber to paper. Reassurance was given by Mr. Scott on these questions. He said that joints had operated successfully at temperatures up to 95 deg. C.



ACCIDENTS—Hours of occurrence of accidents, 1940, as published by the Travelers Insurance Co., Hartford, Conn., in its annual report

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NLRB Approves Offer of Consolidated Edison

The NLRB has approved a stipulation in settlement of complaint against Consolidated Edison Co. of New York under which the utility will pay over to an agent of the board $300,000 in full settlement and payment of all claims arising out of a charge which was filed by the Amalgamated Utility Workers, affiliated with the Utility Workers Organizing Committee (CIO). This sum is to be distributed among 148 employees. The company is to reinstate 60 men who were discharged prior to October 1, 1937.

The company stated that the agreement is "not to be construed or represented as an admission by the company of any improper lay-offs or unfair labor practices, and that all charges be withdrawn."

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RFC May Bid on Issues

Indications that the Reconstruction Finance Corporation may become an underwriter of utility bonds, and perhaps preferred stocks sold under SEC's new competitive bidding rule, were given recently when Federal Loan Administrator Jesse Jones indorsed the rule and said the RFC might submit bids if it became necessary to get "decent rates" and "fair terms" for issuing companies.

•

Nebraska Legislature Rejects Public Power Tax

The Nebraska Legislature has rejected a proposed constitutional amendment to tax acquired properties of public power and irrigation districts in the state. The tax amendment was postponed indefinitely on general file, by a vote of 19 to 11.

This was considered one of the major bills of the 1941 session and would have placed on the tax rolls property already acquired by the districts which had been taxable, future acquired property and purchased municipal utilities. It would have exempted original investments of the hydro plants and future improvements.

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Bonus in Lieu of Vacation

OPM has recommended that defense industries pay bonuses to workers who voluntarily forego vacations this summer. The bonus recommended is an amount of money equal to what workers would receive during the customary vacation period. No effort should be made to coerce workers into not taking vacations if for reasons of health they feel the need of a rest. Such vacations, OPM suggests, should be staggered between May 30 and August 31.

I.E.S. MEETING—Head table (l. to r.) C. W. Keller, Holophane; William Little, Electrical Testing Laboratories; Mrs. Little, W. D. Gorman, Hartford Electric Light, chairman Connecticut chapter, I.E.S.; A. D. Cameron, president of I.E.S.; Preston S. Millar, president of Electrical Testing Laboratories; Samuel Ferguson, president of Hartford Electric Light; C. A. Williams, vice-president of United Illuminating; Mrs. Williams, Lester Graves, Curtis Lighting; O. P. Cleaver, Westinghouse

Hartford I.E.S. Meet Has Live Discussion

Last week the Illuminating Engineering Society held its first northeastern regional conference at Hartford, marked by a record-breaking attendance for gatherings of this kind, presenting 21 papers and addresses in five sessions devoted to current progress in illuminants and their applications.

At the banquet President A. D. Cameron presented Chairman W. D. Gorman of the newly organized Connecticut section with a charter and a myrtle wood gavel from the Portland, Ore., section. Preston S. Millar, president of the Electrical Testing Laboratories, was toastmaster, and Samuel Ferguson, president Hartford Electric Light Co., gave an off-the-record talk on various aspects of power development.

R. B. Brown, Jr., Boston Edison, and I.E.S. vice-president, opened the conference at the G. Fox & Co. department store, which opened its auditorium and other facilities to the gatherings. The modernized lighting of the store (ELECTRICAL WORLD, September 30, 1940) attracted interest among delegates.

O. P. Cleaver, Westinghouse, regional vice-president, said that poor lighting is largely responsible for draftee eyesight rejects in the Army.

R. D. Cutler, vice-president Hartford Electric Light, welcomed the gathering in a short address emphasizing the "tailor-made" aspects of good lighting layouts. The session brought out the value of dramatized displays, "accented" illumination, glare prevention, color values in merchandising, spotlighting as a supplement to general high-grade illumination, and adequate maintenance.

With Prof. A. D. Hinckley of Columbia University in the chair, L. H. Burns, Hygrade Sylvania, reviewed fluorescent source developments, Prof. E. M. Strong of Cornell demonstrated oscillographic analyses of fluorescent lamp flicker and R. F. Hayes, Westinghouse, outlined the possibilities of securing improved fluorescent lamp operation by utilizing frequencies of the order of 400 cycles. Higher efficiencies and reduced stroboscopic effects are associated with such circuits. Train lighting appears to afford market possibilities here. The great need is a small, efficient d.c. to a.c. converter.

C. M. Snyder, General Electric, Boston, led an industrial lighting session in which defense plant illumination received attention.

Walter L. Kelley, Blackstone Valley Gas & Electric, outlined recent successes in dusk-to-dawn rented floodlighting, now totaling 70 installations yielding 46 kw. connected load, 184,000 kw.-hr. per year and an annual revenue of $7,115.

At a symposium on highway lighting, A. F. Dickerson, General Electric, presiding, R. M. Swetland, G. E., was on the program to discuss bridge lighting and Col. M. A. Connor, Connecticut Commissioner of Motor Vehicles, to discuss highways in general.

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Wisconsin Group Elects

Wisconsin Utilities Association in a vote by mail unanimously elected the following officers: President, L. F. Seybold, vice-president of Wisconsin Electric Power Co., Wisconsin Gas & Electric Co., Wisconsin Michigan Power Co. and the Milwaukee Electric Railway & Transport Co.; vice-president, E. R. Felber, vice-president and sales manager of Madison Gas & Electric Co.; treasurer, L. T. Smith, secretary-treasurer of the Milwaukee Gas Light Co.

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Forest Regions Closed to Protect Utilities

Operating areas of the Southern California Edison Co. in the Sierra National Forest have been closed to the public by order of Regional Forester S. B. Show, according to M. A. Benedict, Sierra Forest supervisor.

Secretary of Agriculture Wickard authorized closing the region to prevent malicious damage to utilities and other works important to national defense located in the national forest. The closed areas are in Fresno County in the Big Creek region.

MEETINGS

National Electrical Wholesalers Association—Annual convention, The Homestead, Hot Springs, Va., May 18-22. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

Pacific Coast Electrical Association—Annual convention, Hotel del Coronado, Coronado, Calif., May 21-24.

Missouri Valley Electric Association—Spring accounting conference, Continental Hotel, Kansas City, Mo., May 22-23. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

Empire State Gas and Electric Association—Electric operating group, Van Curler Hotel, Schenectady, N. Y., May 23. George H. Smith, secretary, Grand Central Terminal, New York, N. Y.

Public Utilities Advertising Association—Annual convention, Hotel Statler, Boston, Mass., May 26-27. James Macdonald, chairman, Boston Edison Co., Boston.

National Association of Purchasing Agents—Annual convention, Chicago, Ill., May 26-29. G. A. Renard, executive secretary-treasurer, 11 Park Place, New York, N. Y.

Edison Electric Institute—Annual convention, Buffalo, N. Y., June 2-5. Col. H. S. Bennion, managing director, 420 Lexington Av., New York, N. Y.

American Society of Heating and Ventilating Engineers—Semi-annual meeting, Palace Hotel, San Francisco, Calif., June 16-19. A. V. Hutchinson, secretary, 51 Madison Av., New York, N. Y.

American Institute of Electrical Engineers—Summer meeting, Royal York Hotel, Toronto, Canada, June 16-20. H. H. Henline, national secretary, 29 West 39 St., New York, N. Y.

Pacific Heating and Air Conditioning Exposition—Exposition Auditorium, San Francisco, Calif., June 16-20. Publicity Department, Pacific Heating & Air Conditioning Exposition, Grand Central Palace, New York, N. Y.

American Society of Mechanical Engineers—Semi-annual meeting, Kansas City, Mo., June 16-20. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

American Society for Testing Materials—Annual meeting, Palmer House, Chicago, Ill., June 23-27. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

Society for Promotion of Engineering Education—Annual meeting, Rackham Building, Ann Arbor, Mich., June 23-27.

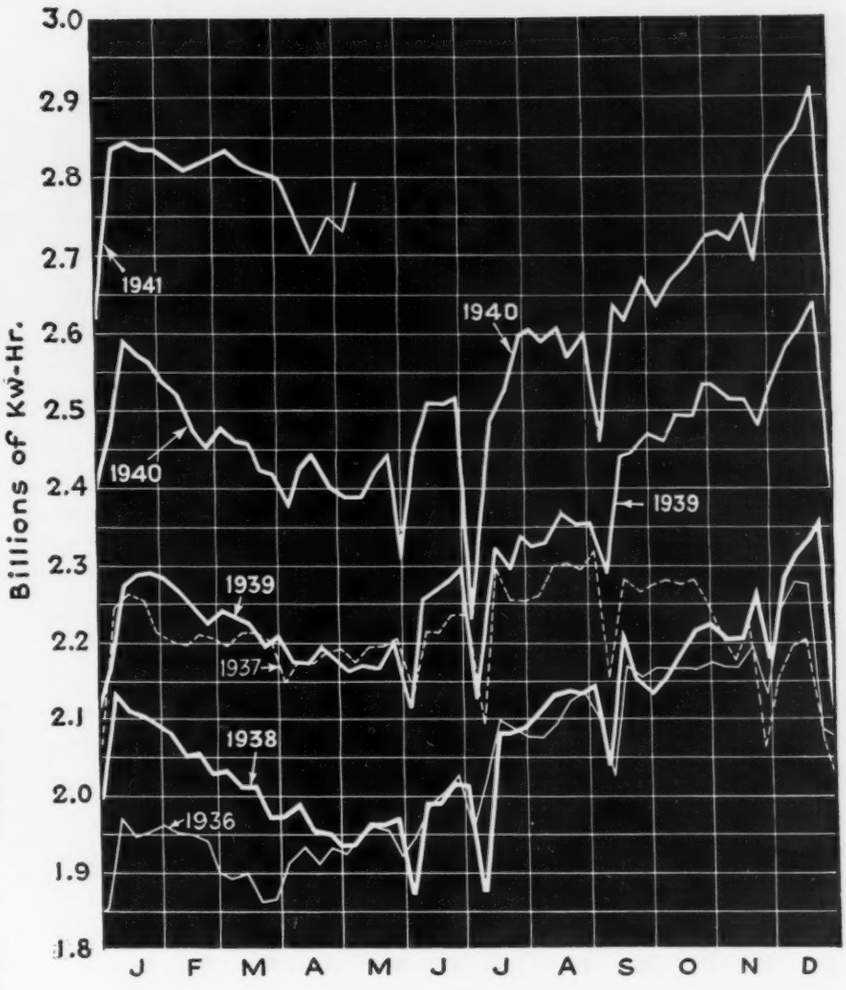
Canadian Electrical Association—Annual meeting, Seigniory Club, P. Q., Canada, June 25-27. B. C. Fairchild, secretary, 804 Tramway Bldg., Montreal.

Power Production Scores Sharp Gain

Eenergy production for the week ended May 10 scored a sharp advance over the previous week as well as a year ago. Total output was 2,791,609,000 kw.-hr., a gain of 16.9 percent over the same week last year, according to report of the Edison Electric Institute. This represented a gain of 2.08 percent over the preceding week and a gain of 28.6 percent over the corresponding week of 1939.

Output for the week showed the largest percentage gain over the preceding week for any week since the second week in January. There has been only eight weeks this year in which weekly output was greater than the week before.

The high rate of industrial activity is responsible for the present trend in power production and is likely to become more pronounced as the defense effort increases and more plants go on a three-shift day. This situation is reflected in the power reports from the major geographic regions where defense orders are concentrated.



Weekly Output, Millions Kw.-Hr.

1941		1940		1939	
May 10	2,791	May 11	2,387	May 13	2,170
May 3	2,734	May 4	2,386	May 6	2,163
Apr. 26	2,750	Apr. 27	2,397	Apr. 29	2,182
Apr. 19	2,701	Apr. 20	2,421	Apr. 22	2,199
Apr. 12	2,721	Apr. 13	2,418	Apr. 15	2,171
Apr. 5	2,778	Apr. 6	2,381	Apr. 8	2,173
Mar. 29	2,802	Mar. 30	2,422	Apr. 1	2,210
Mar. 22	2,809	Mar. 23	2,424	Mar. 25	2,198
Mar. 15	2,817	Mar. 16	2,460	Mar. 18	2,225
Mar. 8	2,835	Mar. 9	2,464	Mar. 11	2,238

Per Cent Change from Previous Week

	Week Ending		
	May 10	May 3	Apr. 26
New England	+26.0	+21.9	+20.5
Middle Atlantic	+15.2	+12.7	+11.0
Central Industrial	+21.9	+18.3	+20.2
West Central	+11.7	+12.0	+13.7
Southern States	+17.6	+15.7	+15.3
Rocky Mountain	+15.1	+16.1	+14.1
Pacific Coast	+ 6.0	+ 7.6	+ 4.7
Total United States	+16.9	+14.6	+14.7

Blakely Dam License Terminated by FPC

Because Arkansas Power & Light Co. failed to comply with the requirements of the license to construct the Blakely hydro-electric development, the Federal Power Commission has terminated the license, effective June 1. The FPC found that the proposed steam-electric generating station in the sour gas fields of Arkansas relates solely to the Blakely development and has dismissed the company's request for its construction.

The commission refused the company's request for a rehearing on an order of March 21, an order in which the FPC denied an application for amendment of license to postpone indefinitely the construction and completion of the Blakely development.

FPC said that the license, as amended July 1, 1935, required that the Arkansas utility should commence construction of Blakely Dam by December 31, 1936, and complete construction for operation of the initial installation on or before December 31, 1939.

Arkansas Power & Light has an application before the state Department of Public Utilities for construction of the steam plant. Approval by the department would give the green light to start the plant without further FPC action.

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Energy Output Gains 16% Over Year Ago

Total production of electric energy for public use during March was 13,097,675,000 kw.-hr., of which 33 per cent was produced by water power, according to the Federal Power Commission. Average daily output was 1.7 per cent below February but 16 per cent above March, 1940.

Reports received during April indicated that the capacity of generating plants in the United States at the end of March totaled 41,912,030 kw., a net increase of 139,421 kw. over reported figures on February 28.

Total coal supplies on hand on April 1 was 12,547,702 tons, an increase of 2.8 per cent over the preceding month and 22.4 per cent over a year ago.

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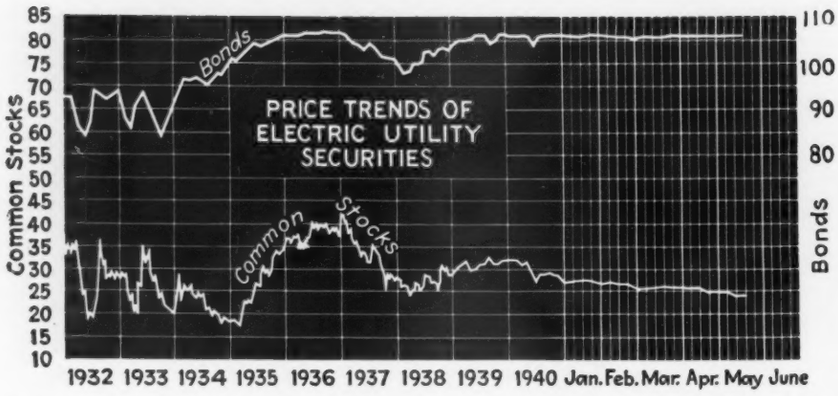
Purchases Columbia Power

The municipally owned electric system of Drain, Ore., became the eleventh such agency to purchase low-cost Columbia River power when its Mayor, C. A. Catchings, executed a twenty-year contract with Bonneville Power Administrator Paul J. Raver. Coincident with the announcement of the contract, Administrator Raver said that the city would reduce its electric rates to retail customers an average of 35 per cent as a result of the power purchase. Drain has operated its own electric power system since 1914.

Utility Securities Move in Narrow Range


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1932 1933 1934 1935 1936 1937 1938 1939 1940 Jan. Feb. Mar. Apr. May June

Few changes occurred in the price of electric light and power securities during the past week. "Electrical World" stock index remained unchanged at 23.8; last year, 29.1. The bond index turned upward—105.9, last week 105.8; last year, 105.4

Detroit Edison Denied Appeal on SEC Ruling

The United States Circuit Court of Appeals in Cincinnati this week denied a petition of Detroit Edison Co. for review of a SEC order in which it was held to be a subsidiary of North American Co. On Aug. 5, 1940, the SEC overruled the Detroit utility's petition that it be held not a subsidiary.

Judge Elwood Hamilton said that "until some order of the commission adversely affects the petition, a challenge to constitutionality validity is premature."

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Utility Offerings Total $32,915,000

New offerings of electric light and power securities during the month of April amounted to $32,915,000 compared with $87,560,300 in March, and $53,489,420 in April, 1940.

For the four-month period ended April 30, new offerings totaled $304,856,300, compared with $268,894,020 for the similar period last year.

Five utility companies participated in the new financing in April and every issue was placed privately. Almost all the money raised was for refunding purposes.

•

American Gas & Electric

SEC in a final opinion reaffirmed this week its tentative conclusions that American Gas & Electric Co. is a subsidiary of Electric Bond & Share Co. The commission observed that a "dominating influence may be exerted in other ways than by a vote." Electric Bond & Share owns 846,985 shares of American Gas & Electric common stock, or 17.51 per cent of its outstanding stock.

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Files $200,000,000 Claim

Petitions have been filed with Judge Vincent L. Leibell in Federal Court, New York City, by the General Protective Committee for fixed interest obligations of Associated Gas & Electric Co., together with fifty individual holders of the securities, for claims totaling more than $200,000,000 against Associated Gas & Electric Corp. for acts allegedly done in the course of a conspiracy with Howard C. Hopson and others to defraud debenture holders.

•

SEC Orders Utility to Recapitalize

New England Public Service Co., a subsidiary of Northern New England Co., has been ordered by the Securities and Exchange Commission either to change its present capitalization, consisting of a number of series of preferred and common, to common stock only, in order to meet with the provision of section 11(B) (2) of the utility act, or as an alternative to liquidate its affairs and distribute its assets.

In its order the commission said it had found that the corporate structure of the company "unduly and unnecessarily complicates" the corporate structure of the system and "unduly and inequitably distributes voting power" among the system's security holders.

The commission added that its decision was based on the facts of "the numerous outstanding series of preferred stocks, the tremendous accumulation of preferred stock dividend arrearages and the doubtful prospect that any substantial alleviation of the company's present financial straits will be forthcoming."

Utility Reports

	Net Income 1941	1940
*Buffalo Niagara Electric..	$3,972,479	$3,369,288
*Dallas Power & Light.....	2,130,312	1,607,122
*Gulf States Utilities.....	2,377,176	2,811,060
*Kansas City Power & Light	3,838,714	3,893,642
*Niagara Hudson Power and subs.	16,815,675	14,287,869
*Oklahoma Gas & Electric	2,537,607	2,834,062
*Pacific Power & Light and sub.	904,622	878,007
*Pennsylvania Power & Light	8,680,869	9,083,319
*Puget Sound Power & Light and subs.....	1,993,246	2,154,486
*Southern Calif. Edison....	12,302,938	12,728,150
*Texas Electric Service....	1,265,371	1,496,148
*Texas Power & Light.....	2,022,878	2,234,742
*Virginia Electric & Power	4,224,180	3,889,718
*Washington Water Power and sub.	2,598,643	3,169,534

*Twelve months ended March 31.

New Issues of Electric Light and Power Securities in April

Name of Company	Amount (Par Value)	Offered to	Period (years)	Class	Purpose	Interest Rate	Price	Per Cent Yield
Buffalo Niagara Elec.....	$7,200,000	Placed privately...	10	Debentures.....	Refunding, construction	2¼	100	2.25
Central Hudson G. & E	13,265,000	Placed privately...	30	1st mtge. bonds.....	Refunding.....	3	105	2.75
East Tenn. L. & Pwr.....	4,800,000	Placed privately...	25	1st mtge. bonds, A.....	Refunding.....	3½	102½	3.35
Florida Power.....	1,000,000 2,000,000	Placed privately... Placed privately...	25 1 Mo.-15 Yrs.	1st mtge. bonds, C.... Serial debentures.....	Refunding..... Refunding, construction	4 3½	104⅛ 100	.... 3.50
Public Service of Ind.....	4,650,000	Placed privately...	30	1st mtge. bonds, B.....	Refunding.....	3½	104¾	3.25
Total.....	$32,915,000							

= $1000

That's the recovery of lost revenue on a typical feeder with the narrower band width held by G-E induction regulators★

Ease and Accuracy of Voltmeter Setting

With the G-E contact-making voltmeter, adjustments for voltage level, band width, and holding effect are completely independent of one another. Furthermore, the value to which any of these is set is not affected by changes in the settings of the other two.

The voltmeter can be set for the desired values readily, without the use of tools.

It is a precision instrument, and once the settings are made, it can be relied upon to hold band width *accurately*.

Evidence of the accuracy of the G-E voltmeter is to be found in its practically flat temperature-accuracy and frequency-accuracy curves, made possible by a special capacitor-reactor ballast.

RECENT tests show that G-E induction voltage regulators hold a 2-volt effective band width, not a 4-volt band width as provided by feeder voltage regulators of other types. This narrower band width means that average voltage can be increased by one volt or more, all along the line, and the minimum voltage raised by 2 volts or more, without exceeding the permissible maximum at the first customer. The result is a recovery of lost revenue amounting to $1000 annually on a typical feeder.

Or, if feeder conditions make it desirable, the advantage of narrower band width can be used to extend your present feeders without increasing the voltage difference between the first and last transformer. In other cases, the advantage can be used to increase load-carrying capacity.

These operating advantages provided by the G-E induction regulator really represent an extra dividend on your investment in regulation. Ask your G-E representative to show you just how much the 2-volt band width held by G-E induction regulators can mean to you in reduced revenue losses, additional feeder length, or increased load capacity. General Electric Company, Schenectady, N. Y.

★For Engineers Who Like to Do Their Own Figuring:
This typical example is based on a reduction of 2 volts in band width on a uniformly loaded 3-phase 225-amp, 4-kv feeder having a 40% yearly load factor and 90% average power-factor; power valued at 3¢ per kw-hr; only the lighting load (50% of total) is affected by voltage changes; power consumed varies as (volts).1.6

GENERAL ELECTRIC

404-22-5406

OPERATING PRACTICES

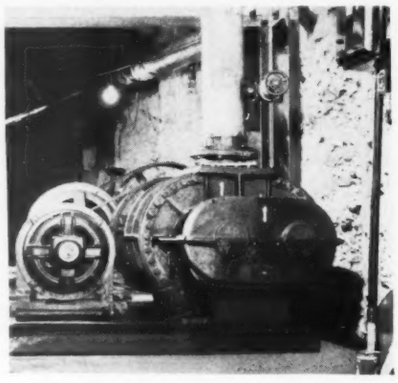
Two Blowers Raise Hydro Output 15%

By W. D. HARDAWAY
Superintendent of Hydro-Electric Production and Transmission
Public Service Company of Colorado, Denver

Generation at a hydro-electric plant in Colorado has been increased 15 per cent during the high-water months by forcing air into the diversion tunnel to reduce roof friction, a method involving only a very moderate investment and making use of two 40-hp. motors driving lobe-type blowers.

Water for the plant operation is diverted from the Colorado River through a 12,500-ft. tunnel which discharges into an open forebay supplying two 9-ft. penstocks, each connected to a 9,000-hp. horizontal turbine. During the summer months, when river flow exceeds plant capacity, generation has been limited by the amount of water which could be delivered by the tunnel.

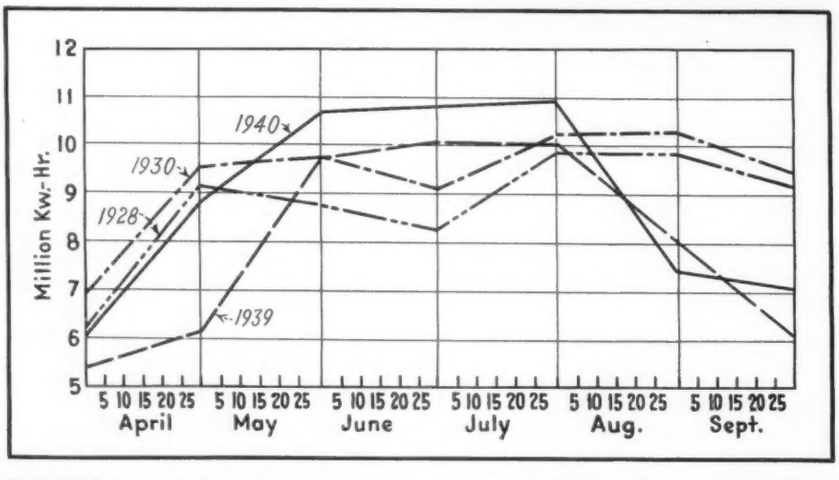
Several years ago the operators observed an increase in plant output for a few hours after the tunnel had been drained. They then experimented by partially closing the intake gates for a short time and obtained an increase in output for a few hours, so that a routine procedure was set up for partially closing, then reopening the intake gates once each shift. This operation was termed "breaking the air lock" by the operators and resulted in an appreciable increase in daily plant generation.



The tunnel is three-quarter lined, with a broken rock roof, and was designed for operation with water levels not exceeding the wall facing. However, since the tunnel capacity limited the plant output during high water, it has been operated full for many years by operating the intake pond with a surface level some eight feet above the elevation of the tunnel roof.

Obviously flow along the broken rock roof was turbulent and retarded flow through the tunnel and so limited the amount of water delivered through the forebay. It appeared probable that the operation which had been termed "breaking the air lock" was actually the exact reverse, and that it reduced friction by entrapping air under the irregular tunnel roof surface. Also, since this operation reduced output temporarily during the period of lowering the tunnel level, it appeared economical to try forcing air into the tunnel without reducing the intake head. A 40-hp. motor driving a lobe-type blower was set up in a construction adit, some 1,750 ft. downstream from the tunnel intake and was piped to deliver about 1,500 cfm. at 2½ psi. through the tunnel bulkhead. Tunnel flow and plant output was increased as shown on the 1939 curve.

On the general theory that if a little air did some good, more air would do more good, air leakage from the tunnel was sealed off and a second similar blower was added in the winter of 1939 and again output improved, as shown on the 1940



BLOWERS force air into diversion tunnel to reduce roof friction, increase plant output 15 per cent during flood-water season

Two 40-hp. motors, similar to the most recent addition shown, drive lobe-type blowers and are set up in construction adit. The comparison curves for the Shoshone hydro plant show: 1928—Continuous flow in tunnel without disturbing air conditions. 1930—"Breaking air lock" in tunnel at about four-hour intervals. 1939—One blower in service, blowing air in tunnel continuously. 1940—Two blowers in service, blowing air in tunnel continuously.

Something DIFFERENT In "Disconnects"

WE left the beaten path when we designed this new kind of disconnecting cutout, and judging from what utility men have been telling us, it's a "natural."

They like the blade fastened to the door so it *can't get lost.* They like the *indicating* feature, which shows at a glance whether the line is open or closed at the cutout. They like the *isolating* feature, which protects the lineman by taking all potential stresses off the door when the line is open. And most of all, they like the *adaptability:* one door fits the housings of both the 5- and 7.5-kv cutouts in the G-E indicating line; doors are available for either 50- or 100-amp housings.

Order a sample disconnect door now. Let your linemen give it the works. You'll find it's a worthy member of the G-E 2-housing 3-door combination for cutout flexibility.

. . . FORMULA FOR CUTOUT FLEXIBILITY

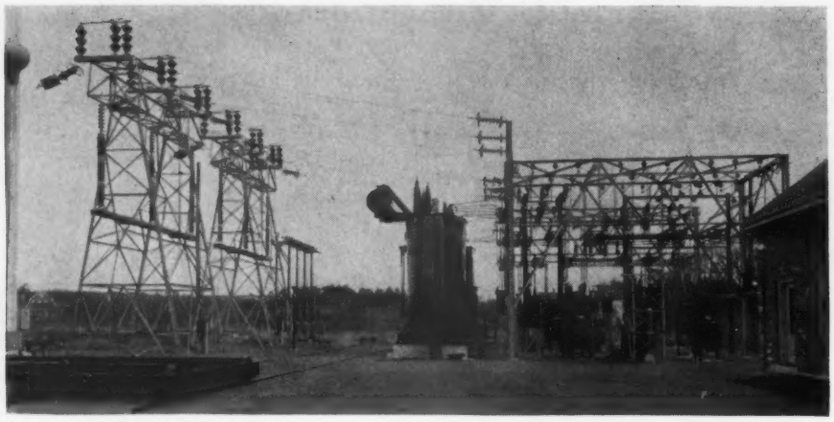
The G-E disconnect door is one of five standard items in the G-E Formula for Cutout Flexibility. Two others are the single-element door and the reclosing door All three doors fit the housings of both the 50-amp, 5-kv cutout and the 50-amp, 7.5-kv cutout Here's maximum flexibility, interchangeability, standardization.

Here are two housings and three doors—*five items in all*—to fill 80 per cent of all distribution fuse cutout requirements. A similar 2-housing 3-door combination in the 100-amp rating is available for the other 20 per cent. Complete cutouts and separate doors are stocked for quick deliveries.

Write for Bulletin GEA-3448. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

406-6



HIGH-TENSION BREAKERS were omitted at receiving substation

curve. The tunnel delivery now matches turbine, generator and transformer safe capacity, so no additional blowers are planned.

The plant crew is entitled to credit for its accurate observation of tunnel flow conditions and for development of these ideas.

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Straight-Line Design Simplifies Substation

The benefits of "straight-line" designing appear in a major receiving substation of an Eastern utility where two 110-kv. transmission circuits deliver energy to transformers for neighborhood distribution to important residential and industrial centers served by 22-kv. lines and lower voltage feeders in the territory. Defense industries are served among others, and the benefits of liberal spacing between all live conductors and associated apparatus, as well as the provision of a clear-cut identification of all circuits and equipment, are important elements in service reliability and trouble spotting. A suburban location for the substation removed the restrictions of real estate costs which cramp so many designs, and in this case the situation was simplified and costs reduced by eliminating 110-kv. oil circuit breakers at the receiving end of the line, depending on motor-operated disconnects for isolation of the high side of the substation at this end and on carrier-operated relay control of the breakers at the transmitting end of the line.

Adequate spacing of conductors and equipment, while fundamental to transmission substation design and no novelty, *per se*, is combined in this case with progressive flow of energy to achieve a layout of exceptional clarity. The incoming circuits are provided with motor-operated air-break switches at the tops of the line terminal structures, whence short runs are dead-ended on strain insulators above the transformer bank, with direct vertical downtakes to the 110-kv. bushings of the latter and short leads to the buses on the secondary arbor at the right, from which overhead and underground conductors lead to other centers, the various 22-kv. breakers being in line with the energy flow. At the extreme left is a transformer maintenance building served by a truck and runway with exceptional clearance for handling units and at the right is a control house completely removed from but accessible to both 110-kv. and 22-kv. arbor.

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Form Records Circuit Regulation Data

By W. B. KENYON
Rochester Gas & Electric Corporation

For recording circuit data to use principally in computing voltage regulation and setting line drop com-

CIRCUIT REGULATION

Circuit	
Station	
Date	

VALUES FOR COPPER, 60 CYCLES, 1000 FT.

CONDUCTOR SIZE		500	350	250	4/0	115	00	0	1	2	4	6	8
RESISTANCE 25° C		.0231	.0325	.0454	.0535	.087	.0846	.107	.135	.170	.270	.430	.682
CABLE	X	.032	.033	.036	.037	.042	.041	.046	.048	.051	.052	.054	.054
	Z	.0394	.0463	.058	.065	.096	.094	.116	.138	.178	.275	.435	.685
WIRE 30"	X	.105	.109	.113	.116		.121	.124	.131	.131	.135	.141	.150
	Z	.107	.114	.121	.128		.147	.163	.182	.214	.302	.453	.695
" 8"sp.	X						.091	.094		.100	.106	.111	

Correction in R = 4% per °C

Location	Dist.	Size Cond.	K.V.A.	Incr. Imp. Ohms	Cum. Imp. Ohms	Calc. K.V.A.	Remarks
1 St. Paul Street	830	115	---	.08	.08	0	
2 First Transformer	2600	2/0	50	.24	.32	2	
3 Ridge Road	1950	2/0	110	.18	.50	55	
4 Long Acre	2200	2/0	120	.21	.71	85	
5. Titus Avenue	4670	2 OH	430	1.00	1.71	735	
6. St.Paul & Belcoda	3000	2 OH	170	.64	2.35	400	
			880			1277	

Computations	RI	XI
0.83 x 150 x 0.087 (R ohms/1000 ft.)	11	
0.83 x 150 x 0.042 (X ohms/1000 ft.)		5
6.75 x 150 x 0.0846 (R ohms/1000 ft.)	85	
6.75 x 150 x 0.041 (X ohms/1000 ft.)		41
3.5 x 150 x 0.170 (R ohms/1000 ft.)	89	
3.5 x 150 x 0.131 (X ohms/1000 ft.)		69
PRIMARY	185	115
SECONDARY	9.2	5.6

Compensation for 150 Amperes		Base Voltage
R =	9	123
x =	6	
Z =		
Drop		

You Can Get FLAMENOL Cable

REG. U.S. PAT. OFF.

RIGHT OFF the SHELF ...and Avoid Delays

STOCK ITEMS

SINGLE-CONDUCTOR 600 VOLTS

Awg	Solid or Strands	Color
18	Solid	Black, white, red, green, yellow, light blue, brown, orange, pink, gray
	19 strands	Black, white, red, green, yellow, light blue
16	Solid	Black, white, red, yellow, brown, green, purple, light blue, orange
	19 strands	All twelve colors
14	Solid	All twelve colors
	19 strands	All twelve colors
12	Solid	All twelve colors
	19 strands	All twelve colors
10	Solid	Black
	19 strands	Black
8	Solid	Black
	19 strands	Black
	37 strands	Black
6	37 strands	Black
4	61 strands	Black

There are also other types available from stock.

Order STANDARDS *for Quick Deliveries*

Flamenol, with its single covering that serves as insulation and finish, is G.E.'s standard synthetic-insulated cable. Flame and oil resistant, it is well suited for machine tools; switchboards and panels; for battery, coil, and certain motor leads; for control and power—in fact, for *all* low-voltage wiring jobs where conditions are severe. To date, some 100,000,000 feet have been sold.

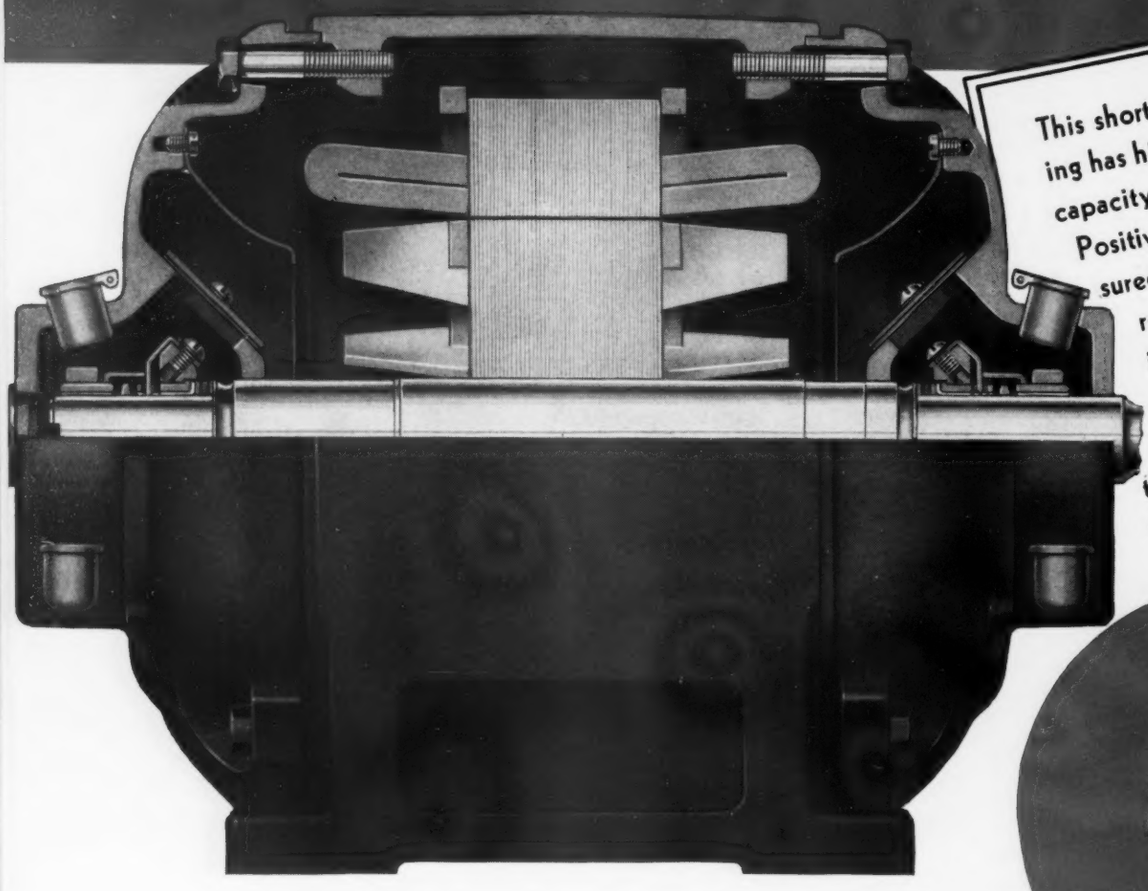
We are stocking about 150 items. By ordering these you avoid delays, eliminate the bother of specials, and get the quickest delivery of a proved product.

For current prices and more details, address the nearest G-E office or G-E distributor. See also Bulletin GEA-2733. General Electric, Schenectady, N. Y.

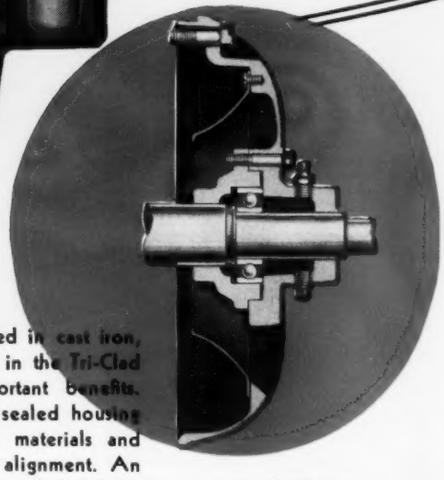
GENERAL ELECTRIC

502-9-1200

We Cut
YOUR MAINTENANCE WORRIES



This shortened sleeve bearing has higher load-carrying capacity and longer life. Positive lubrication is assured by its corrosion-resisting oil ring and improved spiral grooving—the bearing runs full of oil regardless of the direction from which the load is imposed.



Built for protection first...
...to last!

Completely housed in cast iron, the ball bearings in the Tri-Clad motor offer important benefits. The single-joint, sealed housing excludes foreign materials and maintains proper alignment. An improved pressure-relief lubrication system facilitates getting fresh grease where it is needed and helps to expel worn-out grease.

TRI CLAD

INDUCTION MOTOR

GIVES EXTRA PROTECTION 3 WAYS

Extra Protection

against physical damage

The strong, one-piece cast-iron frame and end shields, with upper portion completely enclosed, protect vital motor parts from external blows, flying chips, settling dust, and dripping liquids.

When We Cut

THE ENDS OFF THE BEARINGS

In the Tri-Clad motor, G.E. uses a SHORTER sleeve bearing for LONGER life

Extra Protection

against operating wear and tear

For years, G-E motor designers have been experimenting with sleeve bearings of all kinds. They have found that a shorter sleeve bearing—one with new diameter-to-length proportions and a more effective type spiral grooving—is a fundamentally better bearing; that such a bearing can successfully withstand the stress imposed by short-center, hinged-base drives and similar applications.

In addition, the new sleeve-bearing housings on Tri-Clad motors are dust- and oil-tight. These and many other features are your assurance of a dependable, free-running motor.

In Tri-Clad ball-bearing motors, the bearing is completely enclosed in cast iron. There are only three major parts in the bearing assembly—the end shield, the inner cap, and the bearing itself. Close-fitting running seals keep out ball bearings' worst enemies—dust, dirt, and water.

You'll find that Tri-Clad motors are usually quiet and smooth-running; you'll find that they stay on the line when the going is tough. They'll give your production *extra protection* during *extra* years of service. Specify them on your next motor order. General Electric, Schenectady, N. Y.

Extra Protection

against electrical breakdown

Stator windings of Formex wire give extra protection against moisture, oil, abrasion, and heat shock. A tough, synthetic resin bonds the coils, and a coat of Glyptal 1201 Red on the end windings completes an insulation which maintains its strength during years of strenuous service.

GENERAL ELECTRIC

750-28-8058

pensators a simple form has been found useful on the system of the Rochester Gas & Electric Corporation. The resistances and impedances of standard cables and of open wires in customary sizes (30-in. and 8-in. spacing) are tabulated at the top of each blank for ready reference. Fourteen blank lines afford space for recording as many sections between junctions or taps and also the terminating branches, the length of each section, the size conductor, the kva. (determined from connected load maps), the increment impedance for the section and the cumulative impedance up to each point. The final column records the product of kva. and impedance for load center determination by the method of electrical moments. A typical instance of data thus recorded appears in an accompanying tabulation. In this instance the load center is found at 1.45 ohms (1277 divided by 880) and the point for which to set the line-drop compensator of the regulators is about 3,500 feet beyond point 4 on the circuit.

At the bottom left of the sheet provision is made for recording the computations of R and X settings for the compensator as entered in nearest whole numbers.

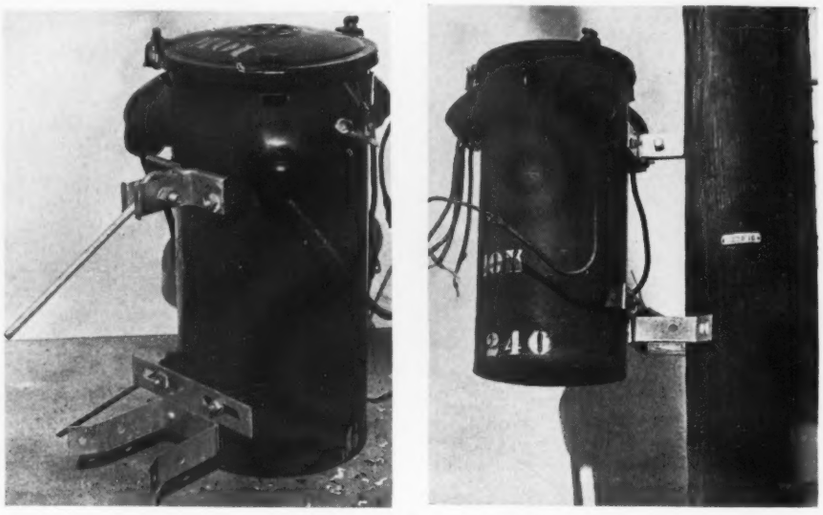
•

Adapter for Pole-Type Transformer Mounts

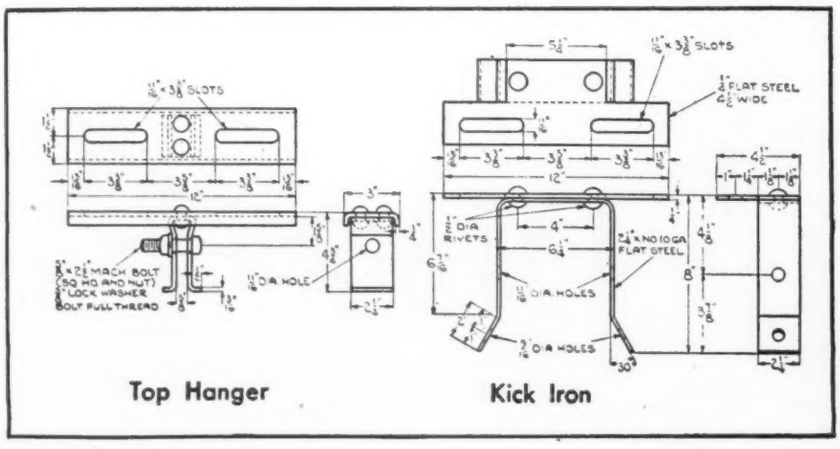
On the New England Power Association system more than 5,000 distribution type transformers have now been equipped with the eyebolt type of pole mounting described by Carl N. Thomas, assistant engineer New England Power Service Co., in ELECTRICAL WORLD May 19, 1939, page 44. This includes both new and old transformers, and the engineering department of the system estimates a minimum saving per installation of $3 through elimination of the usual six-pin crossarm and associated hardware. Adapters for mounting existing transformers by this method are being marketed by Hubbard & Company, Pittsburgh, Pa., and are available for practically all vintages of General Electric and Allis-Chalmers transformers rated from 1.5 to 37.5 kva. and for Westinghouse transformers from 1.5 to 25 kva.

In the previous article Mr. Thomas made brief reference to an adapter development to enable existing transformers to be mounted directly on the pole. This adapter is believed to be the only present available method of so mounting existing transformers. The eyebolt method consists, in brief, of a single through-the-pole eyebolt installation, coupled with a set of adapters which can be obtained to fit any standard make of transformer. The eyebolt provides a closed connection to the top adapter which is bolted to the transformer and provided with a substantial web to prevent displacement. The lower adapter completes a three-point support, giving a rigidity which virtually makes a transformer a part of the pole structure itself.

On heavy installations formerly requiring double-arm construction the saving in material cost and installing time is proportionately greater than above. The adapters are used mainly in changing over reinstalled transformers, as leading transformer makers now furnish new units with eyebolt hanging arrangement on request.



CLOSE-UP of brackets and adapter units before mounting transformer (left). Transformer in place on pole showing adapter and bracket structures securing a 10-kva. unit against jarring loose (right).



DETAIL of hanger and kick iron

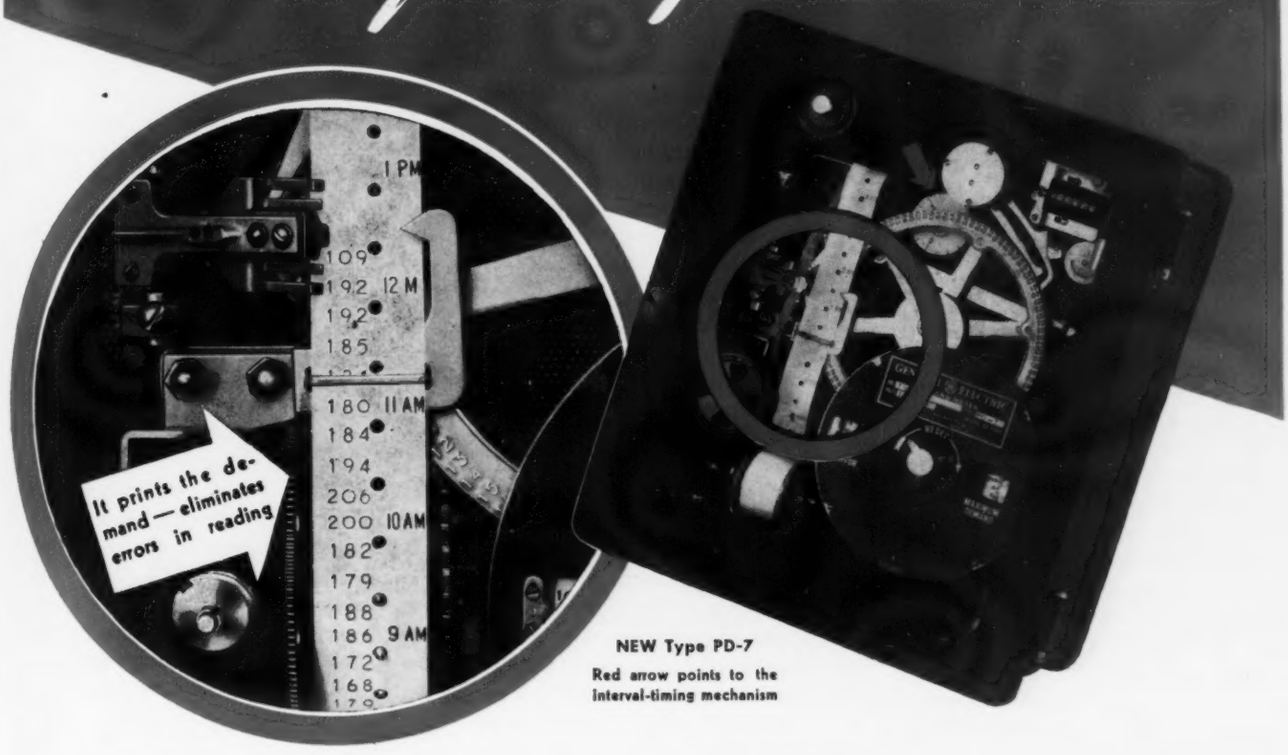
•

Cost of 13-Kv. Fused Disconnects

The following data from operating company records cover the outlay required to install fused disconnect switches on a 13-kv. substation bus in connection with a group of potential transformers:

Six outdoor type disconnecting switches	$175.80
Nine fuses for 13-kv. service	101.25
Two operating eyes	6.00
Two trunnions	6.00
Copper, 6 lb. 1/8 in. x 1 in.	1.62
Miscellaneous material, incl. insurance, and tax	106.99
Transportation	2.62
Labor	65.98
Total	$466.26

Why it pays to use PRINTING DEMAND METERS *on your important loads*



NEW Type PD-7
Red arrow points to the interval-timing mechanism

IT pays because their accuracy assures FULL REVENUE.

The printing demand meter possesses inherent advantages over a curve-drawing recording device. Expansion and contraction of the paper chart, variations in ruled gradations, and shifting of the chart do not affect its accuracy.

Even with its higher accuracy this meter is not complex and delicate. It is sturdily constructed of substantial parts. For routine inspection, the body is hinged so as to give a much-desired accessibility.

TWO TYPES NOW AVAILABLE

1. The Type PD-5, which requires a separate, external contact-making clock.
2. The NEW Type PD-7, which is similar to the PD-5 except that a separate contact-making clock is not required. An interval mechanism of the synchronous type, to establish the time interval but not show time of day, is enclosed in the meter.

Since there is only one device to install instead of two, the PD-7 will save installation space as well as reduce your installation expense.

Your G-E meter specialist can give you further information about both of these meters and will be glad to assist you in applying them. Get in touch with him. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

INDUSTRIAL ENGINEERING

Coal Mine Selects 440-Volt A.C. Service

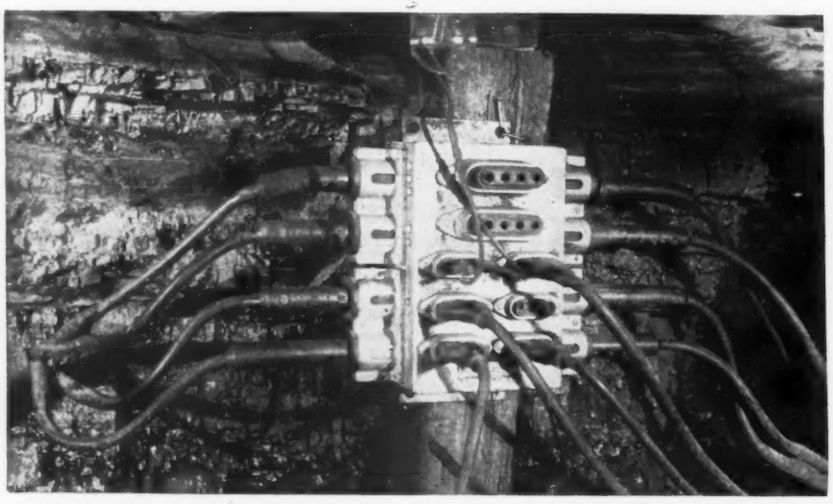
To secure maximum efficiency and eliminate motor troubles and breakdowns, 440-volt a.c. was chosen for all conveyors, mining machines, drills, blowers, etc., at a new conveyor mine of the Wise Coal & Coke Company (Virginia), according to *Coal Age*. The existing 550-volt d.c. installation was utilized for the mainline motor-haulage system.

Four-conductor (one a ground) rubber-covered cable—Anaconda Security-flex type G 133-strand insulated for 600 volts—distribute the 440-volt supply from two underground transformer substations to equipment starters, no fuses being used. Through-type and branch connections for all cables are made with Miller connectors plugged into junction boxes or "gangs," designed for this installation but factory-built. As a further aid to employee safety, these gangs are equipped with male and female connectors, so arranged that the male plugs point toward the source of power and, if not inserted, are "dead."

Purchased 2,300-volt power enters the mine through an Anaconda Duraseal DD rubber-and-braid cable insulated for 5,000 volts and containing three No. 2/0, 19-wire shielded conductors and three ground wires. The underground substations each consist of banks of three 37½-kva. Allis-Chalmers oil-filled transformers which are mounted on mine trucks for moving from one position to the next. Each bank of transformers is protected by an oil circuit breaker with overload trip in the 2,300-volt primary. Entry cables are tied directly to the transformer secondaries. Cable enters the mine via the fanway, where it lies on the bottom; after reaching the main entry, it is trenched into the coal rib.

Entry cables, which are size No. 1/0, are bought in 250-ft. lengths so that they may be hooked together, through their Miller single-pole vulcanized connectors, to form a cable of variable length up to 2,000 ft. Room cables, for distribution from entry gangs to room gangs, are sizes No. 3 in lengths of 300 and 350 ft. Each room cable has a four-pole male connector on one end for take-off from a four-pole female connector on the entry gang and a female four-pole connector on the other end for attachment to a four-pole male connector on the room gang at the working face. Cables attached to the various pieces of machinery have four-pole male connectors vulcanized to their free end. Ground plug and its matching socket on the four-pole connectors are larger in diameter than the conductor plugs and sockets to prevent phase interchange or mixing of ground and conductor.

On the single-pole connectors of the entry cables and on the cases of the entry gangs there are one, two or three prominent "bumps" which facilitate making the proper phase connections. In addition, the ground connectors on these entry gangs and cables are reversed, *i.e.*, cable having three male conductor connectors has a female ground connector.



ENTRY GANG serves as connector and junction for 440-volt a.c. cables in mine One of larger four-pole connectors at top is for room cable, the other is for mine machine cable; smaller female sockets at bottom serve for face conveyor, drill and extra service. Female connectors on cables and gangs point away from source of power and, if exposed, are generally "hot."

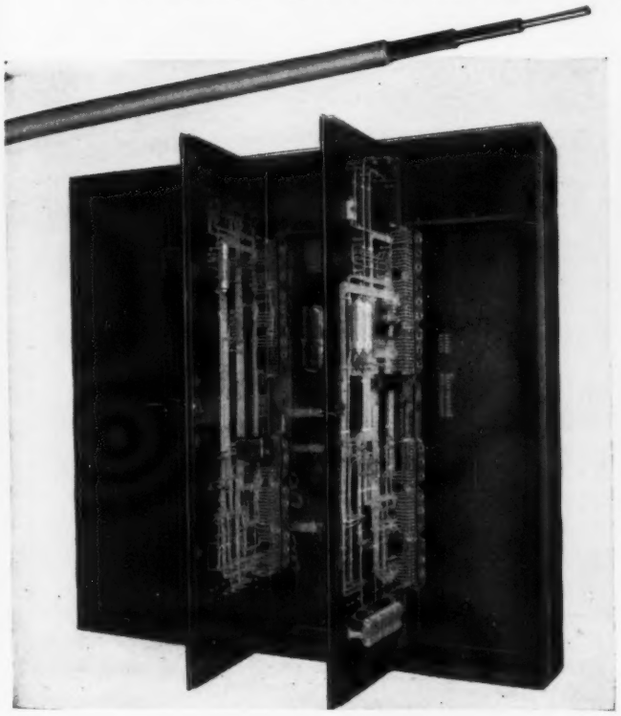
•

Control Cable Plug Cuts Welder Outage

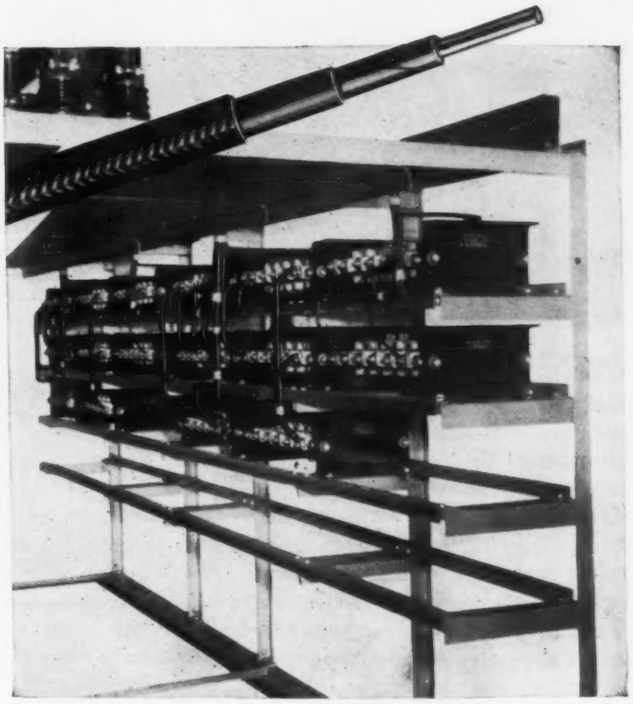
Seaman body division of the Nash-Kelvinator Corporation, Milwaukee, has made effective use of polarized plug connections to reduce the outage

WIRES AND CABLES BUILT TO HANDLE SPECIALIZED JOBS

YOU'LL FIND THEM IN THE G-E DELTABESTON LINE



DELTABESTON SWITCHBOARD WIRE
Won't burn—Waterproof—Extremely flexible—Cuts wiring time—Facilitates installation due to smaller over-all diameter—High dielectric strength due to synthetic insulation—Takes sharp bends easily, without harm to insulation.



DELTABESTON RESISTOR CABLE
Outstanding heat resistance—Easy to work with—Tinned copper conductor—Felted, asbestos insulation, flame-, heat-, moisture-resisting—Tough asbestos outer braid.

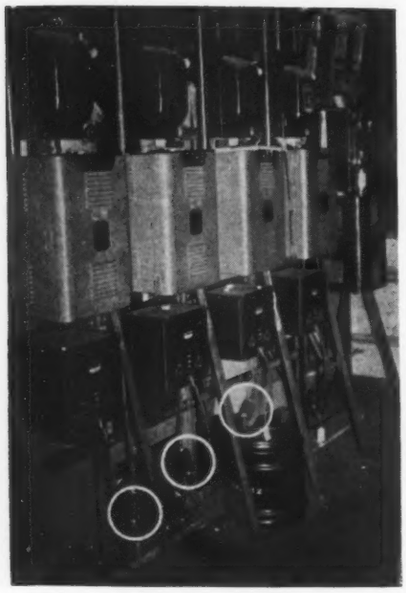
DELTABESTON POWER CABLE Easy to work with—Great resistance to heat, flame, moisture, oil, caustic substances, and abrasion.

DELTABESTON FIXTURE WIRE Highly purified asbestos sheath "felted" on to flexible copper conductor—Great resistance to high temperatures in hot sockets and pendants—Hot wax impregnation for moisture resistance—Polished wax surface for easy pulling—Easy stripping—Uniform diameters.

Deltabeston Wires and Cables are sold by the Graybar Electric Company and by all General Electric Merchandise Distributors.

Why don't you send for your copy of the complete Deltabeston Catalog? Write General Electric Co., Section Y-195, Appliance and Merchandise Dept., Bridgeport, Conn.

GENERAL ELECTRIC



CONTROL leads, multiple prong plugs

time of resistance welders on its assembly lines. Multiple prong plugs are inserted in welder control leads so that in the event of failure in any part of the unit the faulty unit can be disconnected from the controlled welder and a spare plugged in until such time as a repair can be conveniently made. With several hundred weld timers in operation immediate repairs are not always possible.

Plug-in type contactors are now being tried to avoid any loss of manufacturing time when any part of contactor unit needs repairs.

•

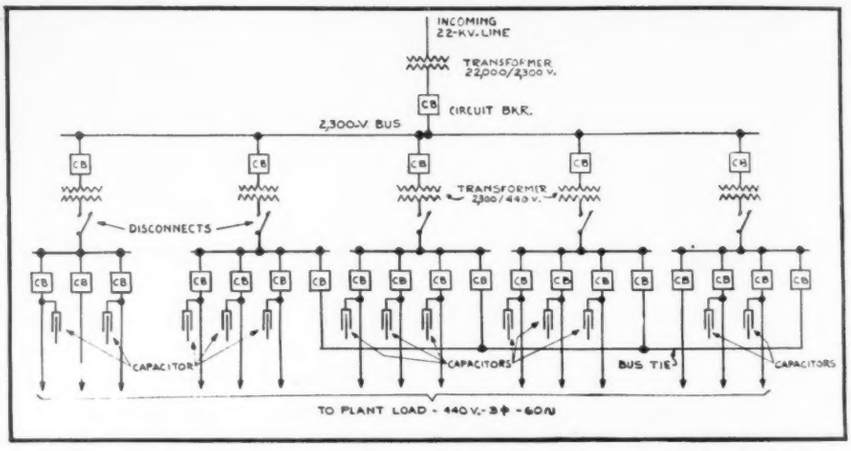
Industrial Electric Fire Lessons

Separation of large oil-filled transformers from important switching equipment by adequate fire walls appears to be a major lesson from a recent fire in a plant using two electric furnaces in steel production. A short circuit occurred in a power transformer, quickly vaporizing the oil, and as a result of the pressure the 333-kva. transformer tank was burst open. About 250 gal. of oil escaped to the floor. The accident occurred on a Saturday afternoon, when the load was about 30 per cent of normal, and the oil did not ignite. The blaze at the transformer, however, damaged nearby transformers and a switchboard. One furnace was out of use 24 hours and production considerably reduced in the other.

In another industrial plant an employee carelessly bridged an overload cutout. A V-belt between a motor and a compressor broke and stalled the motor by winding around its pulley. With the cutout eliminated, the motor roasted itself out, heat set fire to the lint on the machine and internal plant damage resulted. Had the cutout been in service, energy supply to the motor would have been shut off when overheating got under way. A third case where maintenance of better caliber would have saved an hour's shutdown of a large electric manufacturing plant emphasized the importance of regular cleaning of spray booth exhaust ducts in lacquering. An explosion and fire in a neglected section required 45 minutes' work with CO_2 extinguishers to stop the blaze, water being unsafe to use on account of the proximity of lamp-making machines.

• • •

Capacitors Pay Out in Fourteen Months



THIRTEEN banks of Westinghouse capacitors totaling 900 kva. were installed in the 440-volt feeders of a Southern ore refinery, one bank to each feeder supplying a low power factor load. Completely electrified refinery uses squirrel-cage induction motors primarily, whose loading averages about 66 per cent of full-load rating, producing an operating power factor of 78 per cent, subsequently raised to 92 per cent by the capacitor installation. First cost of capacitors—$7,800—was repaid in less than fourteen months.

CAPACITOR banks are mounted on angle racks above metal-clad switchgear. Each capacitor unit is rated 15 kva. at 460 volts. Capacitors are switched out only at infrequent intervals for inspection. Enough spare capacity has been made available in the existing feeders to provide for a fair-sized load increase, if and when it becomes necessary.

NEW ENGINEERING IDEAS

Analyze Unusual Ground Relay Problem

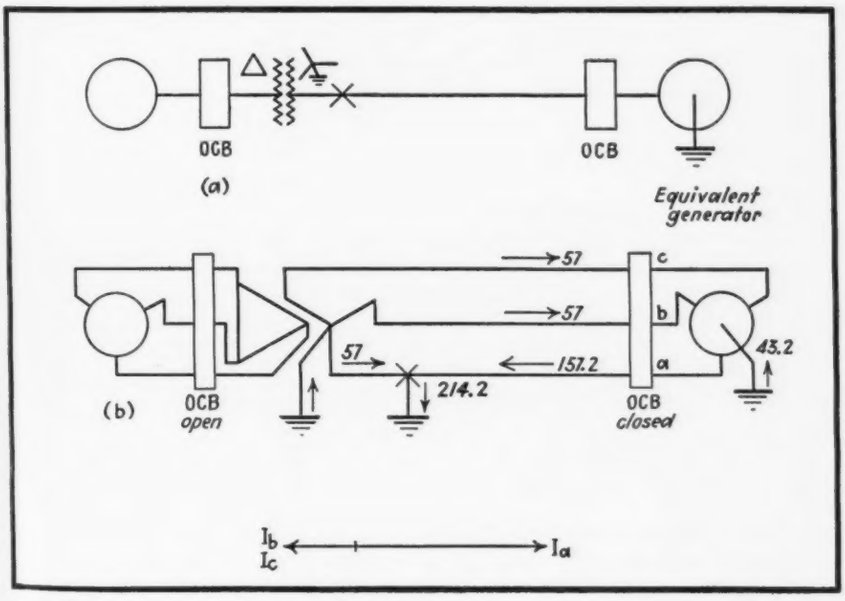
By R. J. W. KOOPMAN
Assistant Professor Electrical Engineering
University of Kansas, Lawrence, Kan.

While the writer was recently making short-circuit calculations and studying relay settings on a power system to which the schematic single-line diagram (a) applies, the following ground-relay problem arose.

When a line-to-ground short circuit occurs at the point marked "X" in system (a) the left-hand breaker opens immediately. The opening of this breaker reduces the current in the fault and hence causes a reduction of residual current flowing from the part of the system on the right of the fault. This reduced current is too small to operate the ground relays at the right end of the line, so the fault continues to be fed from that end.

A vector diagram of line current for the above condition and the magnitudes and directions of the line currents at a particular instant for the same condition (b) will show that, even though the left-hand breaker is open, residual current flows to the fault from the left. This current flows through the primaries of the current transformers, energizing the ground relay coil, and the sum of their secondary currents or the residual current flows through the relay. The 171 amperes residual current overloads the relay coil and will burn it out.

There are several solutions to the problem, but probably the most economical one is to slow down the relay on the left and speed up the relay on the right so that the right-hand breaker always opens first. With the right-hand breaker open and a line-to-ground fault on the right end of the line, the residual current through the left-end relay is about 67 per cent greater than the current through the right-end relay when the fault is on the left end and the left-end breaker is open. This is caused by the fact that in the former case the residual current is fed to the fault from one end only and does not have to divide as in the latter case as shown in (b). This makes it possible to relay faults properly anywhere on the line if the suggested change in timing is made.



CIRCUIT shows conditions under which residual current may burn out ground relay coil even though breaker is open

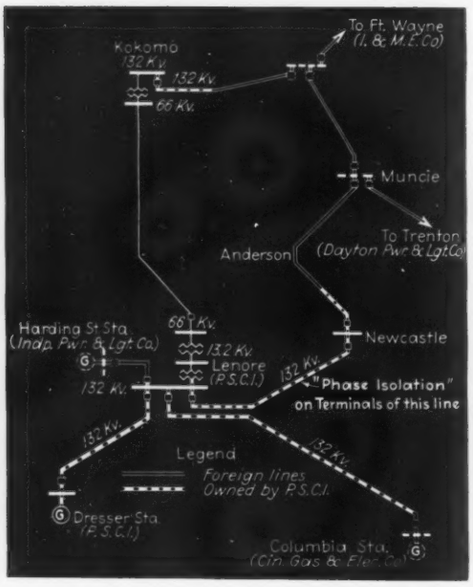
•

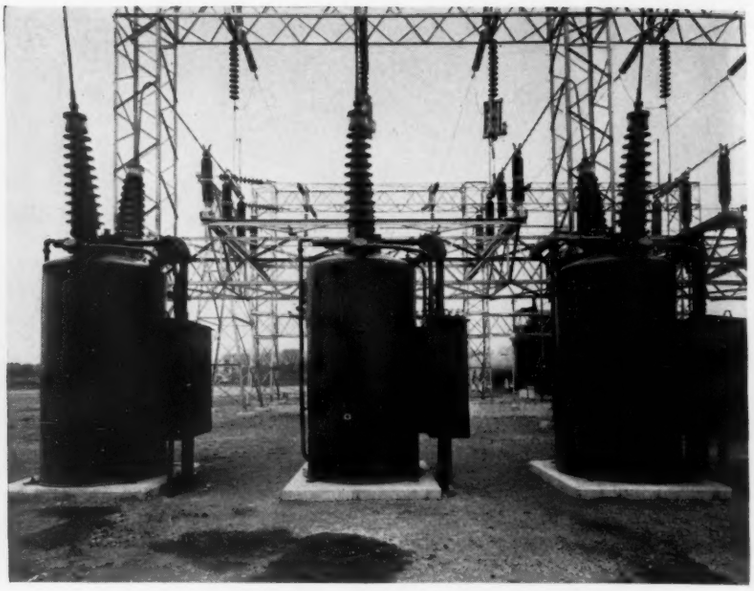
Single-Phase Switching Applied to 132 Kv.

By J. J. TRAINOR
Chief Engineer Public Service Company
of Indiana, Indianapolis, Ind.

When the recent interconnection of the 132-kv. grounded-neutral transmission systems of the Public Service Company was decided upon one of the links—a 54-mile line between Lenore and Newcastle substations—was equipped for single-pole "isolated phase" fault clearing. This system, which was placed in operation and tested successfully under operating conditions Sunday, March 16, 1941, is the first high-voltage installation of its kind in the country and possesses possibilities of solving major transmission line service problems.

Although the principle of single-pole "isolated phase" circuit operation has long been used to carry loads on three-phase grounded neutral distribution circuits during periods of sustained wire trouble, relaying difficulties have discouraged extension of the idea to transmission





FIRST APPLICATION of single-pole isolated phase fault clearing to high voltage transmission is on 132-kv. link between Indiana utility and American Gas & Electric System (left). 132-kv. single pole oil circuit breakers at Newcastle substation (right)

networks despite the advantages it offers over three-pole breaker operation.

In applying the "isolated-phase" principle to high-voltage transmission line operation, engineers of the Public Service Company of Indiana and the Westinghouse Electric & Manufacturing Company have developed an entirely new relay of protective arrangement.

The relay system accomplishes the following general operations:

1. On single line to ground faults the phase in trouble is isolated by the relays and this phase opens at both Lenore and Newcastle substations. The remaining phases are left intact.
2. After the faulted phase is isolated it is immediately reclosed in 25 to 32 cycles.
3. If the faulted phase cannot be successfully restored to service on the initial recloser, all three phases are automatically interrupted.
4. If one phase opens for any reason and fails, after a time limit, to be restored, all three phases are opened.
5. On phase-to-phase or double phase-to-ground faults, all three phases are interrupted.

It will be noted that the present general operating conditions deal only with single line to ground isolation. The relays are so flexible, however, that with minor changes the scheme can be expanded so as to take care of double line to ground or phase-to-phase faults, with or without fast reclosing.

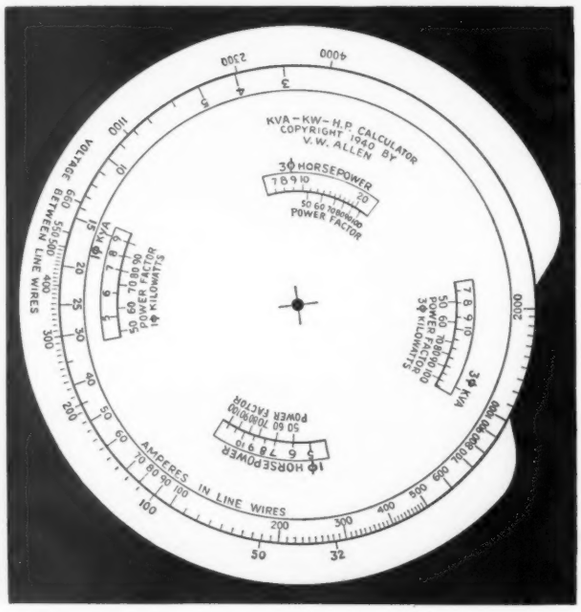
The isolated phase principle is based on the fact that, theoretically, a grounded neutral three-phase transmission network can successfully carry 57 per cent of its line capacity and still maintain stability with one wire interrupted. With conventional three-pole ultra-rapid reclosing breaker scheme which has been used with much success on large transmission networks, much faster breaker operation is required because stability limits are very much less. With three-pole operation, to restore service properly after operation due to single line flashover, the circuit must be re-established in from 15 to 20 cycles. Thus, the breaker mechanism must be developed to a much finer degree of accuracy and must receive expert attention to retain its operating characteristics.

With isolated phase operation the one wire in trouble on a high-voltage transmission network is isolated by proper relaying. Since the system is capable of maintaining stable operation over a longer period of time it is possible to employ standard oil circuit breaker equipment.

• • •

Kva.—Kw.—Hp. Calculator

To interpret readings of clamp-on ammeters, maximeters and other similar instruments in terms of single-phase or three-phase load in kilowatts or horsepower, V. W. Palen, Eau Claire, Wis., has designed the illustrated circular slide rule,* which solves the well-known polyphase relations:



$$\text{Kva.} = \frac{E \cdot I \cdot \sqrt{3}}{1000}$$

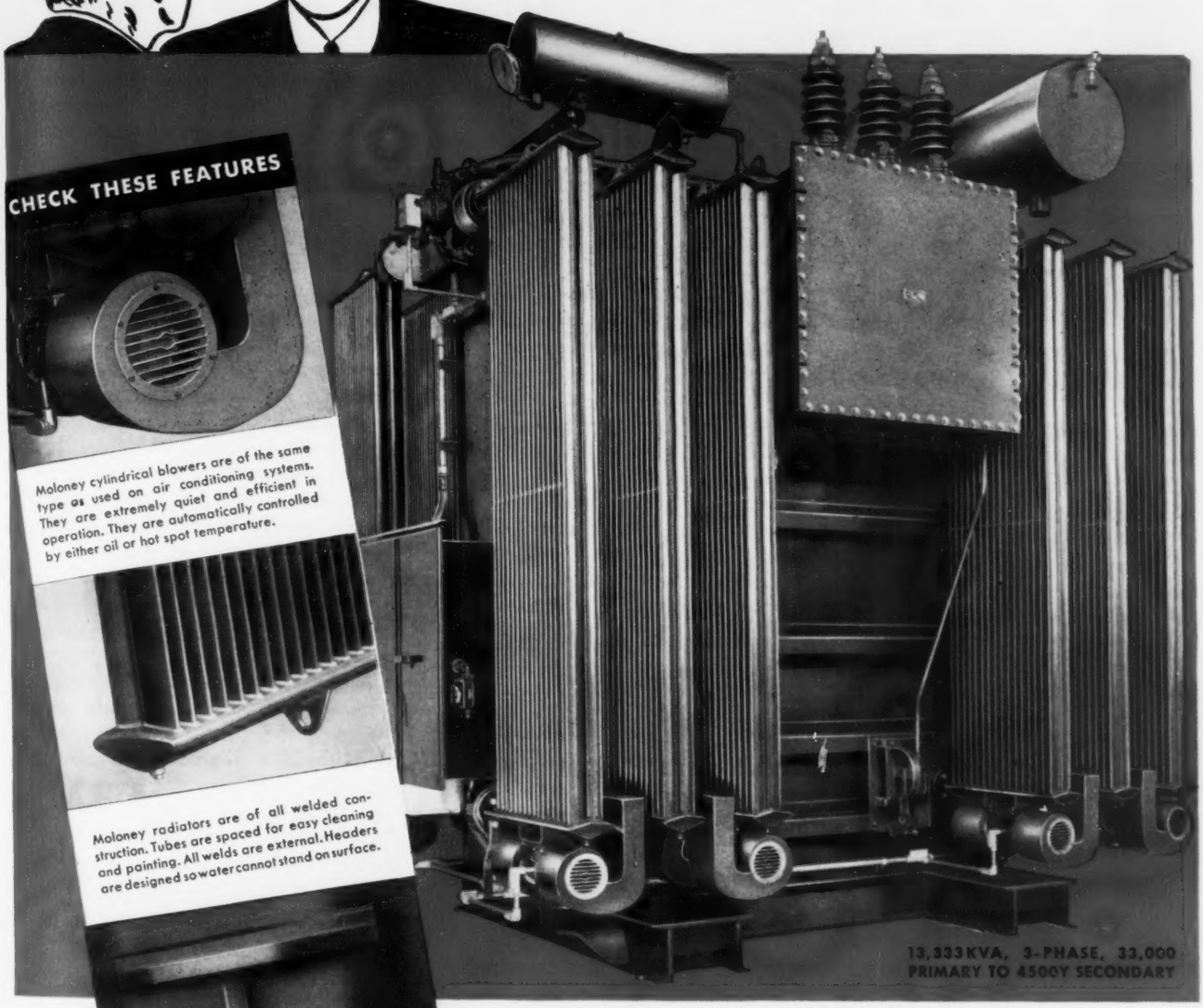
$$\text{Kw.} = \frac{E \cdot I \cdot \sqrt{3} \cdot \text{power factor}}{1000}$$

$$\text{Hp.} = \frac{E \cdot I \cdot \sqrt{3} \cdot \text{power factor}}{746}$$

and their single-phase forms from which the factor, $\sqrt{3}$, is absent, where E and I are line voltage and current respectively, and when power factor of the load is known.

*Copyrighted by Palen who reserves manufacturing rights.

"GIVE ME MOLONEY POWER TRANSFORMERS FOR LOWER MAINTENANCE COSTS"


CHECK THESE FEATURES
Moloney cylindrical blowers are of the same type as used on air conditioning systems. They are extremely quiet and efficient in operation. They are automatically controlled by either oil or hot spot temperature.
Moloney radiators are of all welded construction. Tubes are spaced for easy cleaning and painting. All welds are external. Headers are designed so water cannot stand on surface.
Moloney tanks are sturdily constructed. Tanks walls are adequately reinforced with husky Z bars or strong welded box-type ribbing. Bases are of heavy welded channel iron construction.
13,333 KVA, 3-PHASE, 33,000 PRIMARY TO 4500Y SECONDARY

"For example, just look at this transformer. Notice the radiator construction. There's no place where water can collect and cause rust. Those radiators are easy to clean and paint; the tubes are not crowded together."

"That tank never will give us any trouble. It's strongly built; heavily reinforced where it is necessary."

"Those blowers are driven by weatherproof motors equipped with self-lubricated ball-bearings. They require practically no attention at all; and notice how quietly and smoothly they operate."

Electrically, as well as mechanically, Moloney Power Transformers are well made and require a minimum of maintenance. Send for a copy of Bulletin PR391103 describing other Moloney features and showing Moloney Power Transformer installations.

MOLONEY ELECTRIC COMPANY • ST. LOUIS, U.S.A.

POWER AND DISTRIBUTION TRANSFORMERS EXCLUSIVELY SINCE 1896

LOAD BUILDING

New Playing Field Yields 90 Kw. Load

A floodlighting sale stimulated a major improvement of the football field at South Pasadena High School, California. After Roy E. Dahlin, Southern California Edison Company lighting engineer in the Pasadena district, had interested school officials in lighting the gridiron for night play, they began to consider further improvement of the field, and ended by building a new grandstand seating 2,100 persons.

A total of 90 kw. of light is directed on the playing field by the installation. The east side has four 75-ft. wood poles spaced 100 ft. apart and located 42 ft. from the side line. Each standard is equipped with six Benjamin floodlights using six 1,500-watt lamps. The west or grandstand side of the field has three 85-ft. steel standards, located at the rear of the grandstand, 105 ft. apart and 115 ft. from the field side line. Each standard has twelve Benjamin floodlights using twelve 1,500-watt lamps. The floodlights are mounted in rack formation, six units to a row.

The horizontal foot-candle intensity down the center of the field from one goal line to the other is 7, with a variation of about 0.8 foot-candle between points on the turf. The ceiling is sufficiently high that the highest punts remain in the lighted zone.

The grandstand is lighted by eight 1,000-watt units located at the rear of the structure.

THE IDEA of lighting the gridiron at South Pasadena High School, California, also resulted in building this new grandstand. A 7 ft.-candle illumination is provided over the playing field by lighting units totaling 90 kw.

•

Chicago's Approach to Residential Rewiring

By JOHN B. WATKINS
Assistant to Manager Lighting and Wiring Sales Commonwealth Edison Company, Chicago

There is no easy road to residential rewiring. In fact, we doubt if there is any road at all to rewiring as such. But we have found that a substantial number of people are interested in *additional* wiring.

Wiring is not a fit subject for a "flash" campaign, but it can be made to produce results for all branches of the electrical trade if a steady effort is put behind it. Our studies of the bills of customers having installed additional wiring leads us to the conclusion that the average increase in consumption per outlet is approximately 35 kw.-hr. per year. This increased consumption must come from increased use of existing lighting equipment or appliances, or more probably from new lamps and appliances. Dealers, therefore, have increased equipment sales as a result of an additional wiring activity and contractors in turn have additional wiring work to do.

Our experience leads us to believe that there are five essentials to a successful *additional* wiring activity:

1. Formulation of special bargain offers for specific things to attract public attention.
2. A financing plan more or less comparable to that offered for major appliance sales.
3. A modest but continuous newspaper and direct-by-mail advertising program backed by field solicitation by trained salesmen.
4. Inclusion of contractors in a co-operative plan to do both actual work and help promote the idea.
5. Understanding that the activity is not to be splurged one minute and forgotten the next, but hammered at continuously.

One of the earliest selling devices we used in Chicago to sell additional wiring, and one that we still use extensively in our advertising, is a combination price on three duplex outlets. At present this price is three for $4.75 each, or $14.25.

For this type of activity we consider deferred payment terms essential and have offered them in con-

nection with our additional wiring program since it was started in 1928. At present our terms are 10 per cent down with the balance payable in up to 24 monthly installments. A carrying charge on the initial unpaid balance is added.

All wiring work is sublet to contractors. A price schedule covering many standard items has been established, but where there are unusual conditions the contractor sends an estimator with the salesman to determine the price of the job. Ten per cent is added to the contractor's price to cover the salesman's commission.

Financing Plans

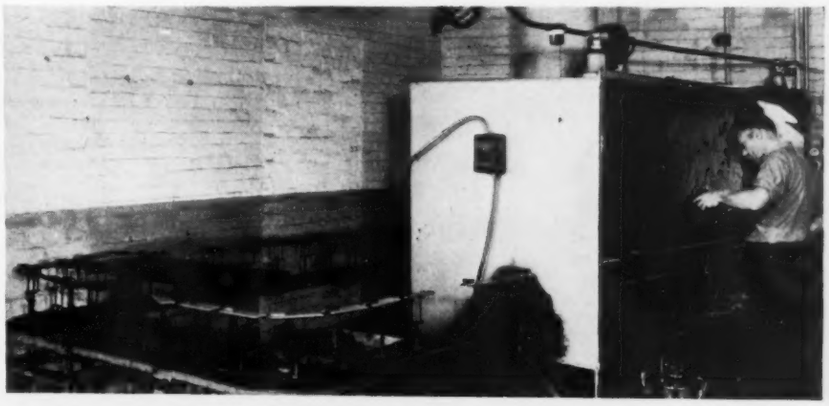
Convinced that contractor participation was hindered by lack of a proper financing scheme, we signed contracts with the E.H.F.A. in August, 1938, to act as collection agent in Chicago under wiring and appliance financing plans. To encourage contractors to sign up with E.H.F.A., and use it, explanatory meetings were held under Chicago Electric Association sponsorship with contractors on the financing plan, the adequate wiring standard and to show them how to sell additional wiring. We believe the increase in the installation of additional outlets in old buildings may be due in part to this work with the contractors and the public's greater familiarity with adequate wiring. City permits for 95,000 additional outlets were reportedly issued in the first nine months of this year. Our sales were about 10 per cent of this.

To promote the activity we support it with practically all forms of printed material. Newspaper ads are placed in the metropolitan, neighborhood and foreign language press of the city. The metropolitan press is used throughout the year, with the frequency and size of ad varied according to the season. The foreign language and neighborhood press is used twice a year, corresponding with the definite moving dates of May 1 and October 1, when we experience peaks in our additional wiring activity. A number of circulars and folders are used; most are hand distributed. Considerable numbers of general folders are mailed to new customers. We pay particular attention to renters, since 80 per cent of our customers are said to live in rented premises and 60 per cent of our orders are for work in rented premises.

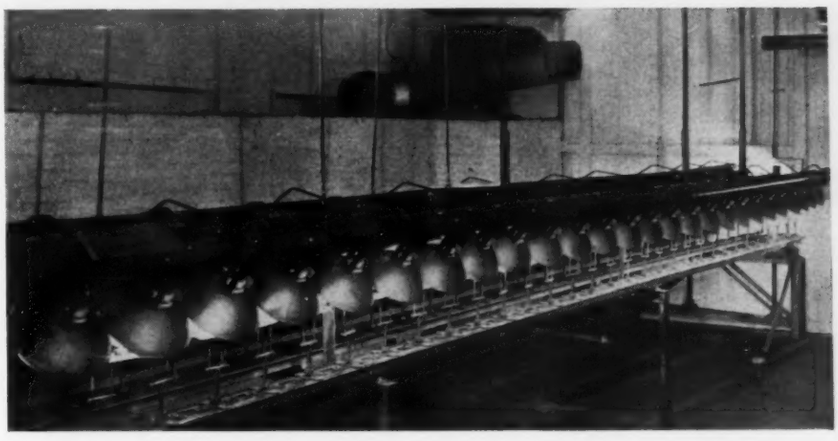
Infra-Red Trebles Production Rate

By installing an infra-red drying installation in its paint department at a cost of $2,091 (labor, $104; material, $1,506, and lamps, $431) the Boston Wire Stitcher Company, East Greenwich, R. I., increased the production of its B-5 stitcher bases in this section of the plant from 1,000 in an eight-hour day to 3,000. On some smaller pieces handled here the rate of drying went up from around 700 to more than 6,000 pieces. This was achieved by a 36-kw. installation of G. E. lamps mounted in six rows at a 45-deg. angle above a continuous conveyor passing directly into a drying room from a spray booth 7 ft. 6 in. long, 4 ft. 6 in. wide and 3 ft. 6 in. high, and designed by the Gifford Wood Company, Hudson, N. Y., for a speed variation of from 2 to 6 ft. per minute. Normally the complete cycle from loading a base on the conveyor to its removal after spraying and drying requires about 40 minutes. There are 136 infra-red lamps in the drying layout, each mounted in a Fostoria "Parasphere" reflector and wired five in series on a 550-volt circuit. The infra-red installation is designed to maintain a temperature of 360 deg. F. at the conveyor level.

The conveyor is driven by a 1-hp., 550-volt, three-phase induction motor running at 1,200 r.p.m., through a variable speed pulley with a diameter range of 2½ to 7¼ in., and thence to a 20-in. pulley which drives the conveyor. At the head of the cycle is a loading and unloading position past which the conveyor is carried across a space 4 ft. 6 in. wide and 4 ft. 6 in. long. After spraying, which requires about 1 gal. of Berry Brothers "Rough Cast Infra-Red Bake" paint per 1,000 pieces put through at about six per minute, the conveyor passes through a wall into the drying room. Here three conveyor loops extend 25 ft. into the room, the last three rows being without lamps as natural drying suffices for the end of the process. Two 250-watt tungsten lamps illuminate the spray booth and two exhaust fans totaling 1¼ hp. remove fumes from the booth and drying room.



INFRA-RED BATTERY is controlled by five sectionalizing switches

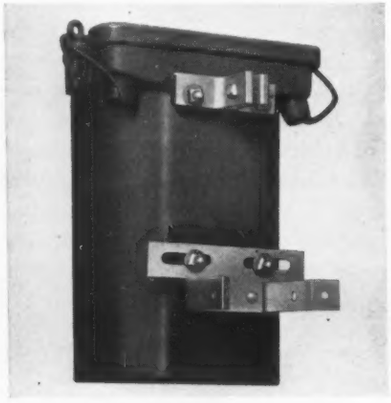


CONTINUOUS conveyor serves spray booth, drying room of Boston Wire Stitcher Co.

NEW EQUIPMENT

Transformer Hangers

A "through-the-pole" eyebolt and a set of top and bottom adapters designed to fit any standard transformers are the component parts made available for a three-point suspension method of hanging transformers. Eyebolt, $\frac{5}{8}$ in. diameter, attaches to top adapter by a machine bolt. Bottom adapter is fastened to pole by $\frac{1}{2}$-in. lag screws.



Transformer hangers, consisting of adapters and eyebolt. **Hubbard & Company,** Pittsburgh, Pa.

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A.C. Generator

A.C. generator, 10 kva., single phase, 1,800 r.p.m., 110/220 volts. **Kato Engineering Co.,** Mankato, Minn.

A four-pole, 10-kva. ball bearing generator has been added to the line of alternators furnished by the company. Voltage regulation between no load and full load is said to be about 8 percent, with a 3 percent speed change. Alternator can be furnished with exciter mounted on outer endbell or arranged for belt drive. Approximate weight 500 lb.

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Industrial Analyzer

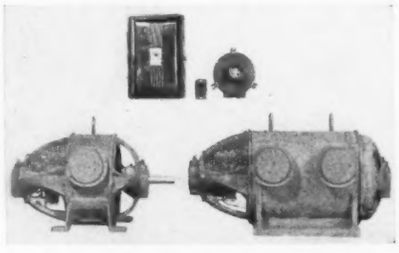
A.C. power industrial analyzer. **Niagara Electrical Instrument Co.,** Buffalo, N. Y.

A portable unit consisting of an ammeter, voltmeter and wattmeter, with suitable current and voltage leads, is available for the following ranges: Amperes, 0-1.5, 5, 15, 50, 150, 300; volts, 0-150, 300, 600; watts, 0-300 min. to 240,000. Power measurements can be made on single-, two-and three-phase circuits. Reactive kilovolt-amperes can be obtained by switching arrangement. Separate case is provided for carrying accessories.

•

Adjustable-Speed Drive

Designed especially for industrial applications requiring adjustable speeds over wide ranges with constant torque, where only a.c. supply is available, a new 10:1 adjustable-speed drive, which uses a series circuit without the usual exciter, has been announced by the company. The new drive has five parts: (1) A single-unit motor-generator set, consisting of a squirrel-cage motor driving a series d.c. generator which supplies voltage for (2) a d.c. series motor coupled to the driven load. In parallel with the generator series field is (3) a rheostat which controls the driving motor speed. Control apparatus



Adjustable-speed a.c. drive. Ratings: 1 to 15 hp., 175 to 1,750 r.p.m.; for two- or three-phase, 220-, 440-, 550 volts, 60 cycles. **Westinghouse Electric & Mfg. Co.,** East Pittsburgh, Pa.

consists of (4) an across-the-line starter for the squirrel-cage motor, and (5) a push-button station. Optional features include dynamic braking and inching. Horsepower ratings are based on top speed of 1,750 r.p.m. at 40 deg. C. continuous operation.

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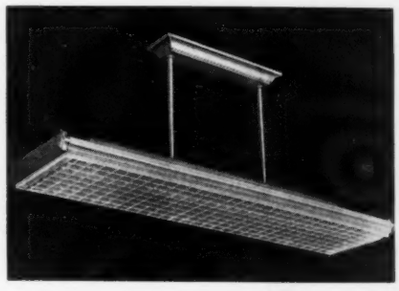
Who Makes What?

"Electrical Buyers Reference," published annually. **Electrical World,** 330 West 42d St., New York, N. Y.

Names, addresses and products of electrical manufacturers are catalogued in this convenient, annual publication for public utility, industrial, engineering and other major electrical buying interests.

Fluorescent Lighting

New lighting units using fluorescent lamps have been announced as an addition to the Silvray line. The units are ceiling and suspension types and have a 12 and 13 in. width and 2 in. depth. On suspension type, amount of light projected upward is said to be 40 percent, downward 60 percent, provided by a diamond reflector system.



"Silvrescent No. 604 F.C." suspension type lighting unit; uses four 40-watt fluorescent lamps. **Silvray Lighting, Inc.,** Long Island City, N. Y.

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Jumper Stick

A jumper stick which permits replacement of the first fuse link in a G.E. 50-amp. and 100-amp. reclosing cutout without interruption to service has been developed by the company. The device consists of a Herkolite tube, housing two cast-bronze, nickel-plated contacts separated by a stainless steel compression ring. Upper contact is fixed; lower contact is movable, secured to a maple pole which slides within the casing and forms the handles of the jumper stick. The contacts are inserted in the opening in the cutout housing. When the device is in place the cutout door can be opened without interrupting

"Cat. 79X324" jumper stick. **General Electric Co.,** Schenectady, N.Y.

"IT MAKES A DIFFERENCE TO ALL ETERNITY WHETHER WE DO RIGHT OR WRONG TODAY" *James Freeman Clark*

AND THAT IS WHY—

UNIFORM HIGH QUALITY

RAW MATERIALS AND GALVANIZING ARE ASSOCIATED WITH *HUBBARD POLE LINE HARDWARE* AT ALL TIMES . . . WHETHER ORDERS ARE FOR FULL CARLOADS IN LUSH PERIODS, OR FOR ONE PIECE DURING THE SLACK SEASON.

THAT *SPRING CONSTRUCTION* YOU ARE PLANNING WILL SERVE YOUR CUSTOMERS IN THE BEST POSSIBLE MANNER IF IT HAS THE UNIFORM DEPENDABILITY, STRENGTH AND DURABILITY THAT ARE SYNONYMOUS WITH THE NAME HUBBARD.

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND . . . CALIFORNIA . . . CHICAGO

"HANG THE LOAD ON HUBBARD HARDWARE"

service, as the load current is by-passed through the shunt connecting the contacts. After re-fusing and closing the door, the contact pressure can be released and the jumper stick removed.

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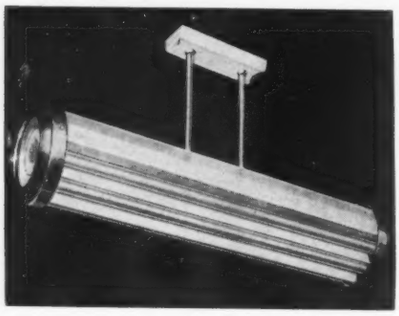
Fluorescent Luminaire

New luminaires for commercial application accommodate two, three, four or six 40-watt fluorescent lamps. Each luminaire consists of two or more trough reflectors



"Permaflector" No. SF-648 series illustrated for six 40-watt lamps. **Pittsburgh Reflector Co.**, Pittsburgh, Pa.

permanently joined adjacently in a one-piece housing. Units are available for surface or suspension mounting and are available with or without plastic inclosures of crystal cellulose acetate to reduce the surface brightness of the lamps.

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Portable Floor Fan

New 36-in. "man-cooling" fan has a low center of balance as it has a cast-iron base. Overall height is 67 in. Four-blade fan operates at 114 r.p.m., circulates air at a rate of 24,000 cfm., and provides a 90-ft. blast of air, it is claimed. Weight 675 lb. A hook is furnished for movement by a crane. It is equipped with a heavy-duty mesh guard, self-cooled motor and starting switch.

Model "36-in. heavy-duty" portable floor fan. **Ilg Electric Ventilating Co.**, Chicago, Ill.

•

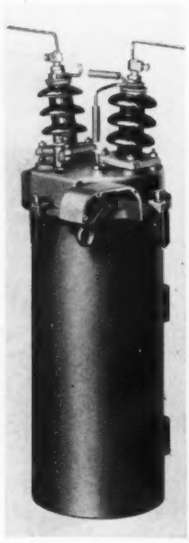
Water Still

Laboratory water still; 3-gal. capacity. **F. G. Stokes Machine Co.**, Philadelphia, Pa.

An improved model of an electrically heated water still has automatic controls to start and stop the still, maintain a fixed level of water in a storage tank, and, after each cycle, automatically flush out impurities from the boiling chamber. Heating element has built-in, dual-purpose thermal safety switch and combined low-water cut-off to prevent burn-out from overheating in case of water supply failure or excessive accumulation of scale. Still is said to be of particular value in hard water districts.

Circuit Breaker

New reclosing circuit breaker for single phase is announced by the company, for use on rural lines in heavy lightning areas and in locations that are sometimes inaccessible. Being fully automatic in operation, the breaker is said to open the circuit instantly when a fault occurs. It automatically recloses after a three-second interval, and must repeat the opening - reclosing operation three times in rapid succession before permanently locking out the line. If one or two operations clear the fault, the breaker still has its full operating sequence, without the need of resetting or attention. Special safety features of the breaker are that it cannot reclose a circuit accidentally and no exposed parts are energized at any time.



Reclosing circuit breaker for single-phase lines. **Line Material Co.**, Milwaukee, Wis.

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Transformers

Types "KL" and "CL" transformers; 1½ to 25 kva., 15,000 volts and less. **Moloney Electric Co.**, St. Louis, Mo.

Two new types of transformers have been made available by the company, to conform with the recommendations of the E.E.I.-N.E.M.A. committee on transformer standardization. Transformers are alike in all respects, except that type KL is equipped with pocket-type high-voltage bushings and type CL is equipped with cover-type high-voltage bushings.

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Test Pump

A small piston type hand pump is available for testing hydrostatically pressure extinguishers and engines of the soda-acid, foam, clear water and anti-freeze types, as well as fire hose and sprinkler systems. Connection can be made through a ¾- or 1-in. garden hose to a source of water supply. Flushing and testing water flows automatically through the pump, without the pump's operating. Only a few strokes are required to bring the extinguisher up to the test pressure. Testing can be readily combined with regular maintenance.

"Testall" pump. **American-LaFrance-Foamite Corp.**, Elmira, N. Y.

TECHNICAL LITERATURE

REPORT—Data on boilers and combustion are contained in a report of the Boiler-Combustion Subcommittee of the Prime Movers Committee, Edison Electric Institute. It contains statements by the committee, operating companies and manufacturers, covering boiler pressure parts, pulverized fuel and furnaces, slagging and furnace cleaning, stokers, oil and gas fuel, and combustion control, which are of interest to operators of steam-generating equipment. Copy may be obtained from Edison Electric Institute, 420 Lexington Ave., New York, N. Y. Price $4 to non-members in U.S.A.

INSULATION STANDARDS—A new handbook entitled "NEMA Steatite Electric Insulation Standards" has been released by the National Electrical Manufacturers Association. The publication contains standards on dimensions and tolerances for Steatite glazed and unglazed posts, tubes, rods, bars, plates, cups, bushings and lead-in insulators. Copies may be obtained from N.E.M.A. headquarters at 155 East 44th St., New York, N. Y. The price is 10 cents per copy.

LIGHTING—For illumination under cranes, data on type of lighting fixture and installation, indoor and outdoor, are given in a seven-page publication that may be obtained from the Holophane Company, 342 Madison Ave., New York, N. Y.

EXHAUST FANS—Where and how to install exhaust and ventilating fans to obtain maximum results; how to determine the size of fan to use for free-air installations; how to select and install exhaust fans with ducts—these and other phases of ventilation are discussed and illustrated in a publication X-4059, "Emerson-Electric Ventilating and Exhaust Fans," available from Emerson Electric Mfg. Co., St. Louis, Mo. The 16-page publication includes calculation and performance data and types of the company's line for various applications.

FLUORESCENT LAMPS—Normal performance, starting difficulty, operating conditions, radio interference are some of the items covered in operating, maintenance and testing suggestions for fluorescent lamps. Information and suggestions are given in a publication, Booklet B Supplement, entitled "Mazda F Lamp Performance in Service," which can be obtained from Nela Park Engineering Dept., General Electric Co., Cleveland, Ohio.

NON-METALLIC MATERIALS—Tabulation of standard sheets, rods, tubes, colors and finishes of Dilecto, Diamond Vulcanized Fibre, Micabond, Celoron and Vulcoid is given in an eight-page folder No. GF-12, available from Continental Diamond Fibre Co., Newark, Del. A chart lists primary and secondary requirements according to dielectric strength, power factor and other properties of the company's products, enabling the selection of material for a specific use.

NEWS ABOUT PEOPLE

Sierra Pacific Utility Elects H. A. Lemmon Head

H. A. Lemmon, who has been vice-president of the Sierra Pacific Power Co., Reno, Nev., since 1938, was elected president of the company at a meeting of the board held recently in Boston.

A native of the California Mother Lode mining region, Mr. Lemmon started his utility career in 1906 when he became Nevada representative for the late Frank G. Baum, noted hydro-electric engineer. Later he was made agent for Mr. Baum's Nevada utility, one of the predecessor units of Sierra Pacific. He remained with the company until its purchase by the Stone & Webster interests.

In 1919 he was transferred to the Halifax, N. B., Stone & Webster prop-

erty as sales manager, and in 1920 went to Boston as personnel manager for all utilities under Stone & Webster control. He held this position for eleven years, when he was forced to retire because of ill health. Some time later, when his health permitted, he returned to Reno as sales manager of Sierra Pacific Power.

▶ EDMUND W. WAKELEE, president of the Public Service Corp. of New Jersey, was one of the group of eight selected by the Alumni Federation of New York University as winners of the 1941 Medallion Alumni Service Awards for "distinguished service to the university."

▶ WILLIAM R. RIVERS, formerly connected with the accessories equipment section of the General Electric Co., Bridgeport, Conn., is now a member of the sales department of Hygrade Sylvania Corp., where he is in charge of the merchandising of special products manufactured by the Hygrade Lamp Division. Mr. Rivers will spend considerable time in the field. His headquarters will be in Salem, Mass.

▶ MILTON SANDERS has been appointed assistant to the president of the Central Arizona Light & Power Co. He will take charge of publicity in addition to general supervisory work. Mr. Sanders joined the utility company in 1935, as advertising manager. Later in the year he was made residential sales manager, the position he held until last year, when he was appointed general sales manager.

▶ STEUART PURCELL, a member of the Maryland Public Service Commission since 1927, has been appointed chairman of the board by Governor O'Connor to succeed OVINGTON E. WELLER. Mr. Weller's term had expired. ARTHUR H. BRICE has been named to succeed Mr. Purcell as an associate member. He has been president of the Maryland State Senate.

▶ G. W. HONSBERGER has been appointed manager of the Westinghouse Electric & Manufacturing Co.'s Louisville, Ky., office, to succeed the late T. W. Voils. Since 1935 Mr. Honsberger has been transportation manager in the Central District. He has been connected with Westinghouse since 1915.

R. L. Smith New President Maryland Utility Group

R. L. Smith, who was elected president of the Maryland Utilities Association at the recent annual meeting in Baltimore (ELECTRICAL WORLD, May

10, page 9), is manager of the Frederick district of the Potomac Edison Co.

Mr. Smith is a native of Frederick County, Maryland, and has grown up with the Potomac Edison organization. He has been associated with the company since 1911.

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▶ O. W. JONES, who for many years has been electric power sales supervisor of Central Power & Light Co., home office, Corpus Christi, Tex., has been appointed head of the commercial and industrial power department. Well acquainted in petroleum and industrial circles throughout Texas, Mr. Jones has been in contact with industrial users of power in this area for many years. For the past fourteen years he has been engaged in industrial power work for Central Power & Light Co. Previous to that time he was connected with the Texas Power & Light Co. in the same

capacity. Mr. Jones is a past-president of the Petroleum Electric Power Association.

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Two New Vice-Presidents Named by Roller-Smith

Announcement has been made by the Roller-Smith Co., Bethlehem, Pa., of the appointment of W. R. Swoish as vice-president in charge of sales and James E. Bevan as vice-president in charge of manufacturing operations.

Graduated from Ohio State University in 1921, Mr. Swoish joined the Westinghouse Electric & Manufacturing Co., where he had a varied experience as a member of the switchgear sales department, salesman in the Buffalo territory, sales manager of the distribution transformer section, sales manager of the oil circuit breaker section and switchgear sales manager. He joined the Roller-Smith organization in January, 1939, as sales manager.

W. R. Swoish

J. E. Bevan

A graduate of Lehigh University, Mr. Bevan entered the employ of Roller-Smith in 1928 after previously having been connected with the Bethlehem Steel Co. and the Philadelphia Electric Co. From 1928 to 1930 he engaged in plant efficiency work. The following three years were spent as a salesman in the New York office. In 1933 Mr. Bevan returned to Bethlehem as a switchgear specialist, which position he held until appointed assistant chief engineer in 1939. In 1940 Mr. Bevan was placed in charge of the Allentown plant of the Roller-Smith Co.

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Sales Promotions Made by Arkansas Power

Four promotions in the sales department of the Arkansas Power & Light Co. have been announced.

Clarence E. Jones, who had been division sales manager in northeast division, becomes general commercial sales manager, with headquarters in general offices of the company at Pine Bluff.

Paul F. Denson, central division sales manager, becomes general residential sales manager, with offices in Pine Bluff.

Both assume part of the duties formerly handled by J. F. Tuohey, who had been residential and commercial sales manager and who is being assigned a new title.

H. C. Roper, Camden, Ark., is promoted from salesman to division sales manager at Searcy to succeed Mr. Jones and William Chapman, salesman, is promoted to central division sales manager at Pine Bluff to succeed Mr. Denson.

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▶ HENRY J. MORTON, who has been connected with the Detroit Edison Co., severed his association with that utility on May 1. In addition to his duties with Detroit Edison, Mr. Morton devoted some time to the industry's new low-cost wiring development.

▶ DANIEL J. MCLANE, JR., former assistant to the production manager in the heavy apparatus division of the Fort Wayne Works of General Electric, has been appointed assistant to Albert S. Murray, production manager Lynn Works of the same company.

▶ EDWIN A. NICKEL has been appointed advertising and sales promotion manager of the Mitchell Manufacturing Co., Chicago, maker of lamps and fluorescent lighting fixtures. Mr. Nickel has eighteen years' experience in sales promotional activity, having served with Hygrade Sylvania, Dictograph Products Co., Lennen & Mitchell and Chas. W. Hoyt Co.

OBITUARY

▶ JOHN H. SCHUMACHER, president of Schumacher-Mackenzie, Ltd., Winnipeg, and well known in Canadian engineering circles, died on April 1 at his home in that city, in his sixty-second year. Mr. Schumacher was born in Dubuque, Iowa, and went to Canada in 1911. He was a member of the American Institute of Electrical Engineers.

▶ ALEXANDER P. MCLELLAN, 45, service manager of the Westinghouse Electric & Manufacturing Co. at Augusta, Me., died in that city on April 15. He was born in Cambridge, Mass., and had been service manager for the company at Hartford, Conn., for five years, at Springfield, Mass., for fourteen years and at his late post for about a year.

▶ C. G. MURDOCH, assistant secretary and treasurer of the Laclede Power & Light Co. and a member of the board of directors, died on April 20, in St. John's Hospital, St. Louis. Mr. Murdoch became assistant commercial manager of the Laclede Gas Light Co. in 1914. Ten years later he was appointed superintendent of new business of the electric department. When Laclede Power & Light Co. was organized, in 1927, he continued in the same capacity. In 1938 Mr. Murdoch was elected assistant secretary and treasurer of Laclede Power & Light Co., and in 1940, he was made a director of the organization, continuing in the office of assistant secretary and treasurer.

▶ ARCHIBALD K. MACNAUGHTON, distribution betterment engineer, Ebasco Services, Inc., died in March, 1941, at Atlanta, Ga. He was 47 years of age. Mr. MacNaughton entered the employ of the El Paso Railway, Light & Power Co. in 1916, the first of several companies under Stone & Webster management with which he was associated. In 1918 he was made general superintendent of the Ponce (Puerto Rico) Railway & Light Co., and in 1920 went to the Blackstone Valley Gas & Electric Co., Pawtucket, R. I., as electrical engineer, later becoming superintendent of distribution. He served as electrical engineer for Stone & Webster, Inc., Boston, Mass., 1926-27, and for the Narragansett Electric Co., Providence, R. I., 1927-28. Then for four years he was planning engineer for the Georgia Power Co., Atlanta, and from 1932 to 1938 supervising engineer for the Commonwealth & Southern Corp. at Birmingham, Ala. He had been with Ebasco Services since 1938.

High-tension power lines must withstand — continuously and unfailingly — all conditions of nature. If they fail, wheels stand still and windows are dark. Because of this increasing dependency upon the uninterrupted flow of high-tension electricity, utilities and other industrialists are increasingly turning to Blaw-Knox Transmission Towers. Well-known to operating engineers everywhere are Blaw-Knox's unequaled facilities for the engineering, designing, fabricating and galvanizing of transmission towers. You are invited to discuss your situation with Blaw-Knox.

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MANUFACTURING - MARKETS

Washing Machine Sales Up; Billings Spurt

Easy Washing Machine Corp. sales for the first four months of 1941 show a substantial increase over the same four months of last year and billings for the 60-day period ended April 30 are the largest in the history of the company, J. C. Nelson, president recently stated.

Mr. Nelson further stated that work is now going ahead on the development and tooling of an automatic washer containing revolutionary features, following the loss of some of the patterns in the recent foundry fire, and that molds, tools and dies are also being released to provide substitutes for aluminum, zinc and other materials affected by priorities in defense.

It was further stated by Mr. Nelson that production facilities had been expanded and additional overtime schedules have been put into effect to meet the greatly increased sales volume and that every effort is being made to make deliveries on outstanding back orders. The company recently erected an additional warehouse approximately 60x300 ft. to provide additional warehouse and manufacturing facilities.

•

Refrigerator Shipments Hit New High in 1941

Shipments of Crosley refrigerators for the first four months of 1941, plus unfilled firm orders now on hand, amount to 111 per cent of the company's total refrigerator shipment for the entire year of 1940, Robert I. Petrie, vice-president and general sales manager, has announced.

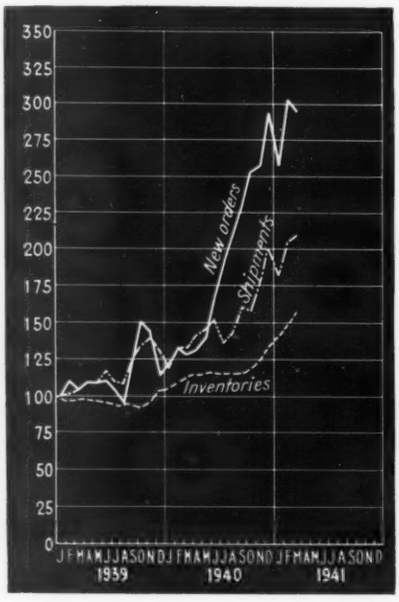
A new high record for refrigerator shipments was established during the first four months of 1941, in which period 107 per cent more refrigerators were shipped than during the same period last year. This passes the previous record of 102 per cent more shipments made during January and February than during the first two months of 1940, Mr. Petrie said.

•

Electrical Equipment Index Moves Higher

While there has been a slight slackening of new orders placed for electrical machinery, shipments and inventories show a further increase as reported by the Department of Commerce. This is due largely to the substantial part of defense orders placed some months ago.

The index of new orders placed in March was 295, against 303 in February and 129 in March, 1940. The index of the value of inventories was 157.2, against 148.2 in February and 114.5 in March last year. Shipments increased and the index for March was 210, against 205 in February and 133 in March, 1940. The value of unfilled orders rose 9 per cent from February and was 266 per cent above a year ago.



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

Manufacturers Show Increase in Net

McGraw Electric Co., in report for twelve months ended March 31, subject to audit and year-end adjustments, shows net income of $1,647,724, after depreciation, federal and state income and excess profits taxes, etc., equal to $3.49 a share on 472,600 shares of capital stock. This compares with $1,462,584 or $3.09 a share for the 12 months ending March 31, last year.

Report states that provisions for federal income and excess profits tax for twelve months ended March 31 were based on rates that were in effect for the calendar year 1940 and no provision has been made for increased taxes that probably will be payable for the three months ended March 31, 1941.

Sales for twelve months ended March 31, last, amounted to $8,876,210, against $7,084,646 in the preceding twelve-month period.

Other manufacturing companies recently issuing earnings reports follows:

OKONITE CO.—For 1940, net income, $419,063, compared with 1939 net loss of $36,258.

CONTINENTAL-DIAMOND FIBRE — March quarter, net profit, $153,103, after $68,000 reserve for contingencies and $171,000 provision for income taxes, compared with net profit last year of $168,378 after $36,600 provision.

REVERE COPPER & BRASS—Including wholly owned subsidiaries for quarter ended March 31, subject to audit and year-end adjustments, net profit $1,053,747 after interest, depreciation, amortization and federal income and profits taxes, including provision for estimated increase in such taxes. Net is equal after dividend requirements on 7 per cent cumulative preferred and 5¼ per cent cumulative preferred stocks and allowing for dividends on class A stock, to $1.20 a share on 563,619 shares (par $5) of common stock. This compares with $720,196, or 61 cents a share, on 562,867 common shares reported for March quarter of previous year.

HARVEY HUBBELL—Net income for 1940 totaled $503,910, equal to $3.15 a share. This compares with $390,178, or $2.44 a share, in 1939.

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(the CONTINENTAL-DIAMOND Laboratory)

to help solve that new "What Material?" problem . . . possibly also that unsolved old problem . . . it may be electrical, mechanical, or structural . . . involving replacement of weighty, corrosive, costly or hard to get metals with one of the varied and versatile C-D Products:

1. A wide experience with many types of materials prevents any bias in our recommendations.
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3. Manufacturing facilities are extensive and complete. Five basic plants . . . three completely equipped fabricating departments, Newark, Delaware; Valparaiso, Indiana, and Toronto, Canada.

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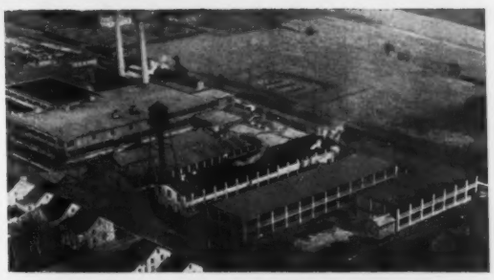

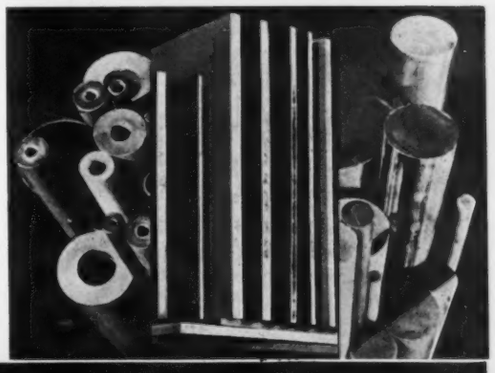

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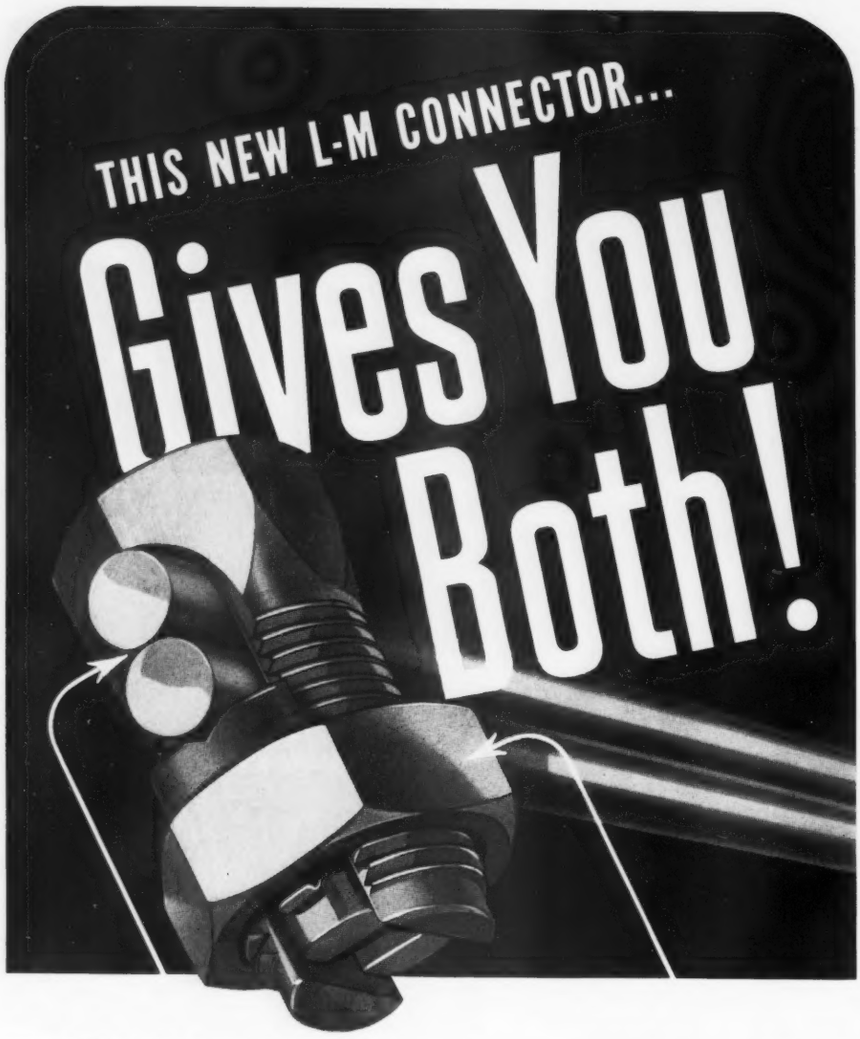

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HIGH ULTIMATE TORQUE

Even the No. 6 size of L-M High Strength Connectors takes the highest torque a lineman can ordinarily apply with pliers and a wrench. Larger sizes reach new highs in ultimate torque strength.

Now is the time to place your order for L-M High Strength Connectors . . . available with or without the nut retainer feature as you prefer.

LINE MATERIAL CO.
MILWAUKEE · WISCONSIN
LM

Lynn General Electric Works Production Rises

Nearly $550,000 a week now represents the payroll of the General Electric Company's River Works at Lynn, Mass., total employment being close to 12,000 and production far above last year's output, Manager Nelson J. Darling told a meeting of foremen.

The expansion program is proceeding smoothly and since January 1 there has been a further large addition of floor space and the addition of about 200 new machine tools. National defense is responsible for this development and the total outlay for expansion at the Lynn Works, including facilities at Everett, is about $14,000,000. For the second time in three years the Everett plant has won the Massachusetts safety award.

•

New Orders at Peak

The value of new orders of electrical goods booked during the first quarter this year reached a new all-time peak of $554,115,468, as reported by 78 manufacturers to the Department of Commerce. This compares with $514,816,295 in the last quarter of 1940 and with $238,845,964 in the first quarter last year. Total orders booked by these manufacturers during 1940 totaled $1,433,377,755, as against $869,524,769 in 1939 and the former peak of $1,065,510,043 in 1929.

•

Allis-Chalmers Order

Allis-Chalmers Manufacturing Co. has received a $263,522 award from the Navy Department for construction of a 6,000-kw. turbo-alternator for the Washington Navy Yard and a 4,000-kw. turbo-alternator for the Naval Operating Base, Norfolk, Va. The company is given 300 days to complete the work.

•

Fort Contract Awarded

Commanding Officer, Fort Lewis, Wash., has awarded a contract to City Electric & Fixture Co., Seattle, Wash., at $186,943 for construction of power substation and extensions in transmission lines at local field.

New York Metal Prices

	May 13, '41 Cents per Pound	May 7, '41 Cents per Pound
Copper electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.85	5.85
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spots	7.64	7.64
Tin, Straits	52.75	52.00
Aluminum, 99 per cent.	17.00	17.00

*Delivery Connecticut Valley.

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..Light Weight
..Completely Insulated Jaws
..±2% Accuracy

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..Large 2¼" Square Opening
..Long Open Scale
..50 Scale Divisions
..10 Years' Proven Service

ALSO MULTI RANGE CLIPON AMMETER 0-10/25/100/250/1000 AMPS. LIST $120.

PHASE ROTATION INDICATOR

..Instant Indication of Phase Rotation
..110/550 Volts
..2½" Portable Pocket Model

LOW COST

..Complete with Heavy Insulated Leads
..Heavy Clips with Rubber Guards
..Also Flush and Surface Types

LIGHT WEIGHT

NEW HIGH ACCURACY PORTABLE VOLTMETER

..0–150/300/750 Volts
..Long 5¼" Scale
..½ of 1% Accuracy
..AC-DC
..Hand Calibrated Mirror Scale
..150 Scale Divisions

..Frequency 15–135 cps.
..Hinged Cover with Leather Carrying Handle
..Light Weight—Robust Construction
..Conforms to A.I.E.E. and N.E.M.A. Specifications

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2 *Heavy, all Copper Shell*

3 *Side wall wire release*

And now, the new Fargo Sag Guide

Sag Guide markings on the Fargo Line Splice show how much conductor length goes inside the splice. As a result you know right where to cut the wire in order to keep the sag aligned with other spans. Saves guessing, and time.

In *grip*, too, Fargo is first. Holds solid or stranded wires permanently. Stock up now on all sizes of FARGO LINE SPLICES . . . "the sure splice".

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Field Reports on Business

Defense contracts continue to swell the volume of industrial production, with many lines showing sharp expansion. Plant expansion is contemplated by many companies to provide more production facilities. Electrical orders are mounting, with shipments moving. Utilities are planning further plant expansion.

NEW YORK

Priorities are expected to become of more importance in coming months than had originally been anticipated. A trend toward what may be expected in the future is seen in the proposal by the National Bureau of Standards for the adoption of a simplified list of stock sizes of copper conductors as a means of reducing unnecessary inventories of copper wire to effect economies and to conserve materials.

The Federal Reserve Board's drive for tighter credit terms on durable consumers' goods is likely to stimulate forward buying of electrical appliances and other home furnishings. When the restrictions become effective they are likely to restrict sales of major appliances on which credit is now being extended up to two or more years. The increase in earnings of those in the so-called low-income bracket has opened new markets for electrical appliances since the defense program got under way. It is this group the board is aiming to restrict large-scale deferred payment plans.

Washing-machine distributors in this area, who normally keep a month's stock on hand, are now down to a few days' supply. Demand since the start of the year has exceeded expectations, with shipments running 25 per cent above a year ago. Prices are expected to rise with advances of $10 having been recorded.

Air-conditioning sales are expected to spurt in this area, stimulated by the "package" models. Industrial use is on the upswing.

NEW ENGLAND

Defense contracts continue to mount in this district and the demand for motor-driven machine tools reflects a steady upward trend in small motor sales. Among recent outstanding orders which involve electrical equipment are a $2,000,000 milling machine order placed with Van Norman Machine Tool Co., Springfield, Mass.; $43,986 worth of motor-driven air compressors, Norwalk Co., Inc., South Norwalk, Conn., $118,236 to Rivett Lathe & Grinder Co., Inc., Boston.

Massachusetts' share in recent allocations by the Defense Plant Corporation include $6,000,000 to General Electric for construction and equipment for the manufacture of superchargers and other aircraft parts and accessories at Everett, Mass., and $1,113,495 to Wyman-Gordon Co., Worcester for the manufacture of aeronautical accessories. A contract totaling $950,000 for a power plant has been awarded to Stone & Webster Engineering Corp.

Electric cable awards during the past week include $28,650 to Collyer Insulated Wire Co. and $73,198 to Rockbestos Products Corp. During the past week War Department contracts amounting to more than $350,000 were awarded to Massachusetts manufacturers of cloth and rubber products.

Wiring supplies for light and power are moving well. Increased employment and wages have stimulated buying of major electrical appliances. Electric refrigerators were included in an estimated $55,000 for appliances to be installed in a Lowell, Mass., housing project. Range sales are increasing in the eastern Massachusetts district and laundering equipment is attracting attention.

CHICAGO

Business activity continued to move forward at a rapid pace, with some lines picking up even greater speed. All production records in the steel mills of this district will be shattered this week as the schedule calls for the greatest output ever attempted.

Wholesale and retail trade last week maintained a high volume of sales, making gains of 15 to 20 percent over a year ago. A record attendance has been reported at the Home Furnishing Markets, with sales running approximately 30 percent ahead of last year.

Over $16,000,000 has been invested for additional plant facilities in this area during the past 30 days. Kellogg Switchboard & Supply Co. has ordered $400,000 in new machinery. Certificates of necessity for plant expansion were issued to Electro-Motive Corp. for $1,868,000 and to Stewart Warner Corp. for $1,317,000.

Iowa Electric Light & Power Co. announced a $4,000,000 improvement program for its Iowa properties. Hubbard Steel Foundries has just installed six electric furnaces costing $285,000, while the Wilson-Jones Co. has installed eight electric strip heaters.

Defense orders totaling $2,615,500 were placed here last week, including electric furnaces, $116,970; transformers, $70,593; wire and cable, $25,135; switchboards, $96,881; motor-generator sets, $49,854.

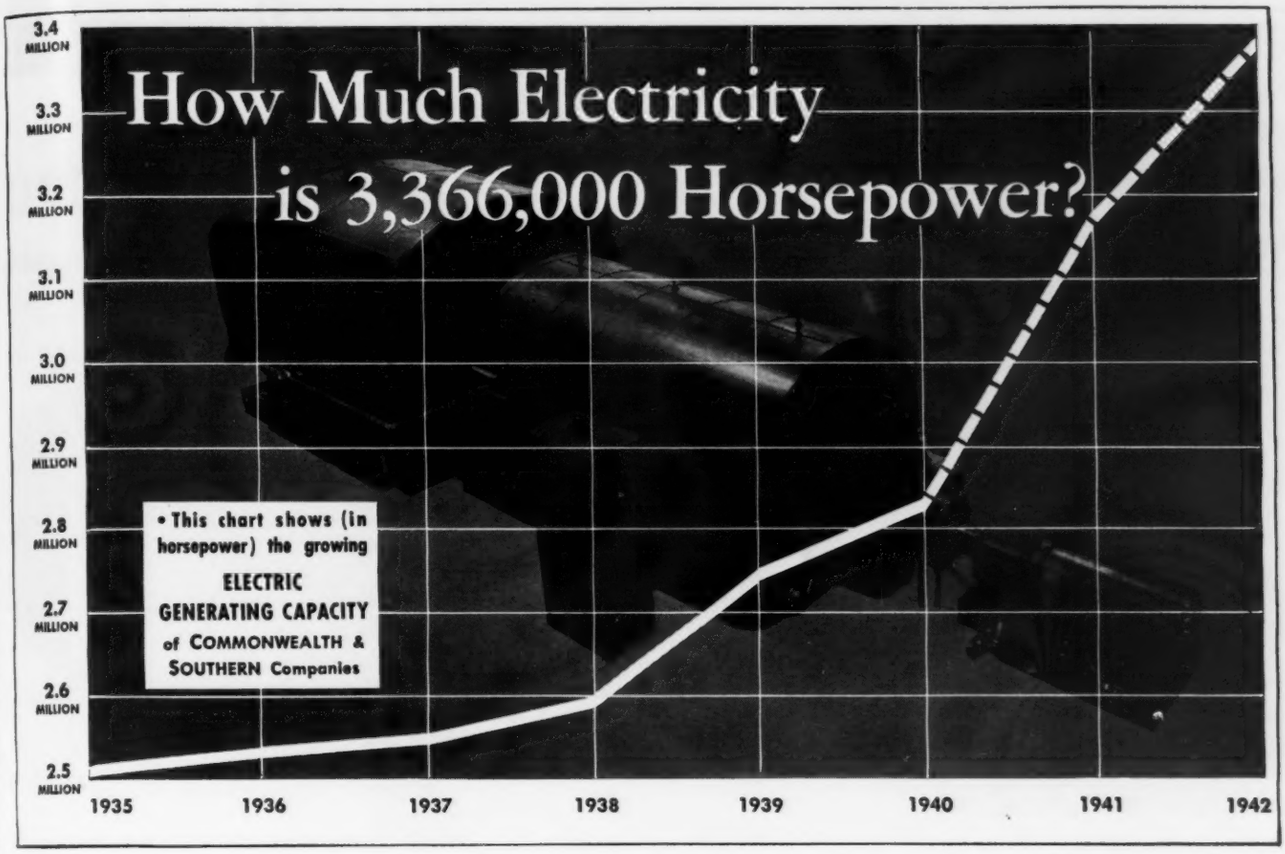
PACIFIC COAST

Several large general appropriations for yards, camps and fields have just crystallized into specific electrical orders, such as a $900,000 award for additional machinery, substations and distribution lines for Mare Island Navy Yard, including $225,000 of the heaviest circular mil sizes of varnished cambric cable for drydock wiring and ship connections.

Grand Coulee business includes $120,000 Corning Glass insulators for Covington transmission line and $133,221 award for 115-kv. line between Walla Walla and Lewiston.

Westinghouse was awarded $137,489 generators and appurtenances for Los Angeles Harbor steam plant and Burbank has bought $30,000 Kelman circuit breakers. Southern California Edison is buying several carloads of hardware for its Boulder lines and switchyard, and recent Pacific Gas & Electric staple business has included $40,000 street lighting transformers, cable and standards and $60,000 step-voltage regulators.

Various iron and steel companies have just bought 22 large G.E. motors, value $15,000, and $75,000 switchgear equipment; $18,000 pyranol transformers and two 300-hp. synchronous motors and switches, value $30,000; $65,000 of switchgears and transformers were shipped to Arizona for installation in Parker Dam plant.



THE U.S.S. Colorado, a completely electrified battleship, has an electric power plant of about 40,000 horsepower. Electricity drives this giant ship, even cooks the meals . . . performs a hundred vital tasks. **That 40,000 horsepower is enough to supply all the electricity normally used in over 100,000 homes.**

As it takes about two years to complete a modern powerhouse, electric capacity of Commonwealth & Southern companies, which is available and being installed, is important to the nation as well as to the areas they serve.

Soon, these companies will have a "fleet" of plants with a total minimum electric capacity of 3,366,000 horsepower **... an amount probably greater than all the electric energy used on all battleships in the world's major navies.**

A battleship is used merely to illustrate the tremendous growth in power facilities of Commonwealth & Southern companies . . . at a time when electric power also is so vital to the defenses of the nation.

On January 1, 1936 the total electric capacity of Commonwealth & Southern companies, in the ten states where they operate, reached 2,502,000 horsepower.

Since then, one or more new generating units have been put into operation in every year. In 1939, upon the outbreak of the war in Europe, this building program was further stepped up.

At the end of 1940 we had placed in service ten new major generating units and our total electric capacity had reached 2,824,000 horsepower.

And this year, we already have additional new units under construction which will further raise our capacity, by next year, to a level of at least 3,366,000 horsepower . . . a level which is 35% above that of 1935.

Together with scores of urban and rural communities, there are over 25 important industrial cities within the areas served by Commonwealth & Southern companies. Defense contracts running into hundreds of millions of dollars have already been allotted in many of these cities.

Commonwealth & Southern companies are located in five Northern States: Michigan, Illinois, Indiana, Ohio, Pennsylvania . . . and in five Southern States: Alabama, Georgia, Florida, Mississippi, South Carolina.

The Commonwealth & Southern Corporation and affiliated companies will use **to the fullest** their combined experience and their resources to aid the nation's defense program and for the continued benefit of all of the many communities served.

Justin R. Whiting, PRESIDENT

Greater Strength for the Nation

• A group of companies were brought together in 1930 to form the Commonwealth & Southern companies. Their average home electric rates and the average use of electricity in the homes they served were then almost identical with the averages for the Nation.

Today, home electric rates of Commonwealth & Southern companies average 22% *less* than the average home rate paid in the United States. And, the homes served by these companies are using, on an average, about *34% more electricity* than other American homes.

More than 19,000 people are now employed in the operation of this business. Many more are at work building new plants and equipment, for which (including all additions to property) we already have expended, since 1936, over $175,000,000.

The Commonwealth & Southern Corporation

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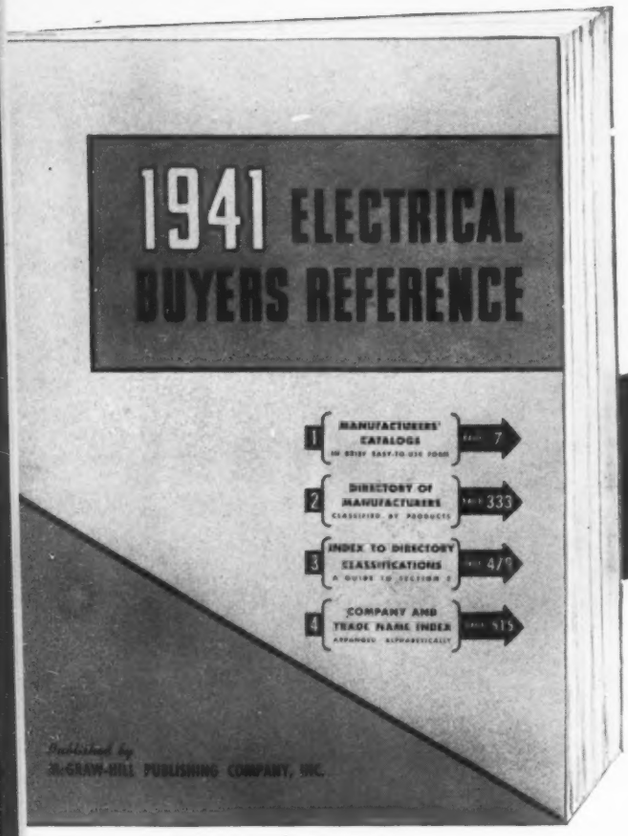
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2 DIRECTORY OF MANUFACTURERS CLASSIFIED BY PRODUCTS
3 INDEX TO DIRECTORY CLASSIFICATIONS A GUIDE TO SECTION 2
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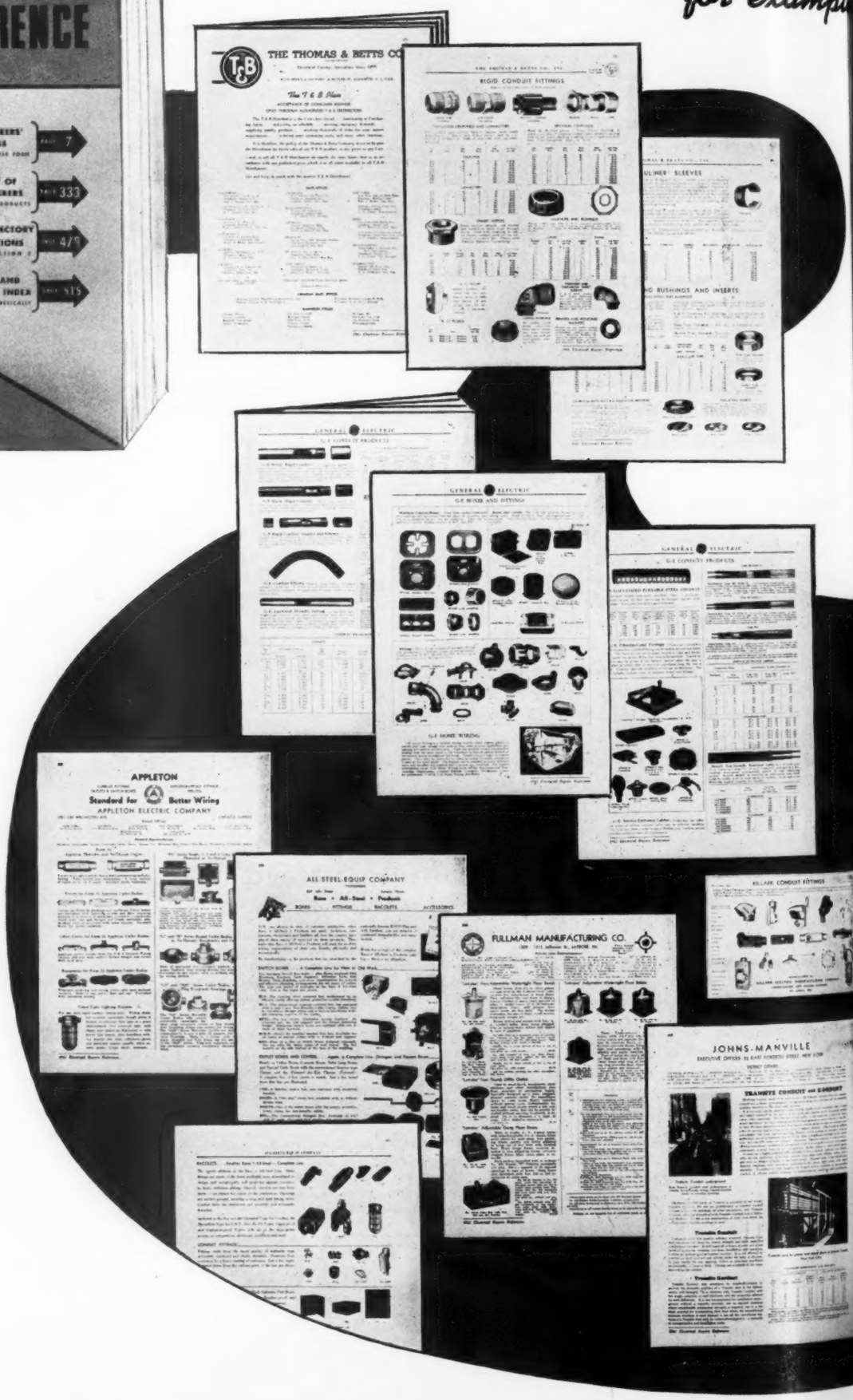

WHY? Folks have written us asking *why* we run these ads, if we're not trying to sell copies of the Electrical Buyers Reference. Frankly, the purpose of these displays is to impress upon the 30,000 electrical men who *have* received the book that there's a wealth of valuable catalog data in it—and we illustrate with the material on just one class of product "fer-instance".

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P. S. 26 leading fittings manufacturers have catalogs in Electrical Buyers Reference. We've reproduced some of the data contained in these catalogs . . . to give you a quick idea of the completeness of the material in Electrical Buyers Reference.

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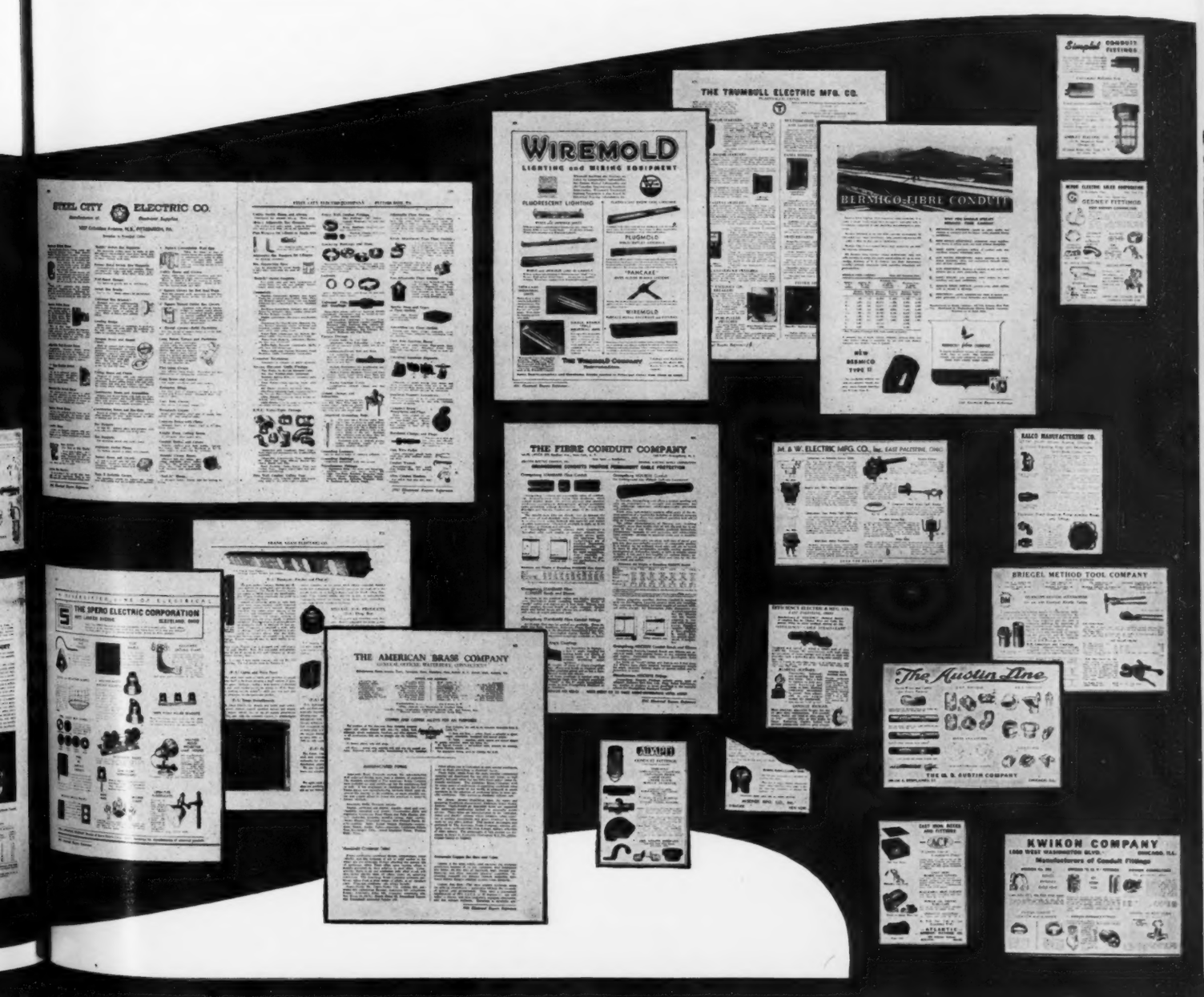

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Recent Legislation

Action has been taken on the following utility legislation in the various states:

FLORIDA—For the fourth time in the last four legislative sessions a house utility committee has killed a proposal for statewide regulation of electric and gas companies. The measure sought to have electric and gas companies regulated by the railroad commission, the same as telephone, telegraph and railroad companies. The committee vote was 12 to 2.

MICHIGAN—A bill has been introduced in the legislature, permitting combination of cities, villages, or townships in the creation of special districts to provide electricity.

NEW YORK—Governor Lehman has vetoed the Ryan bill to amend the tax law, in relation to aiding municipalities in valuing real property of a public utility, and making an appropriation for the department of taxation and finance for its expenses in connection therewith. In disapproving this bill the Governor said: "This bill was introduced at the request of the smaller municipalities of the state in order to furnish to them the expert guidance and aid of our department of taxation and finance in connection with the valuation of utility property. The State was quite willing to assume this new obligation and pay the cost thereof. The appropriation requested by the State department of taxation was reduced after the bill had been introduced. The State cannot undertake to render these additional services unless sufficient appropriation is made." The Governor also vetoed the Moffat bill to provide that no expenditures shall be made out of proceeds of securities issued by the New York State Power Authority for any purpose other than payment of expenses of issuance of securities until advances made by state appropriations shall have been repaid, and strikes out provision that appropriations made by state may be repaid out of excess revenues from any project. In disapproving this bill the Governor said: "I believe with the sponsor of this bill that the state's advances to the Power Authority should be repaid at the earliest possible opportunity. However, this bill may defeat its own purpose by precluding such repayment out of excess revenues of a power project."

OHIO—Gov. John W. Bricker has approved a measure extending to April 30, 1943, the sixty-five-hundredths of 1 per cent utilities excise tax for poor relief purposes.

PENNSYLVANIA—A bill was introduced in the House by Representative Joseph J. Hersch which would prohibit public utilities from imposing penalties for failure to pay charges promptly.

TEXAS—At the instance of Governor W. Lee O'Daniel, a bill has been introduced in the Legislature to regulate the activities of public utilities in connection with elections on municipal ownership. It would prohibit interference with any election, except that in case of an election "directly affecting the granting, refusing, existence or value of any franchise granted to a corporation which has the right of eminent domain," such company would be granted the right to present facts and arguments to the voters on such question "by any lawful means of publicity and pay the expenses thereof." It proposes a limit on the amount, the exact figure left to the legislature's decision. The bill would require a company to file with the secretary of state a sworn report of the amount of money spent, the way in which it was spent and to whom promised or paid. It imposes a penalty of up to $5,000 on any officer, director or employee of a corporation violating the act, or a jail sentence up to six months. The bill would re-enact all present provisions against a corporation's taking any part, or its officers or directors acting for it, spending in money or making any contributions to "aid or hinder the nomination or election of any person" to any office; or to influence any vote, except in connection with a franchise matter.

•

Recent Rate Changes

PACIFIC POWER & LIGHT CO. has announced reduction of 17 per cent in light and power rates to users served by the company in eastern Washington and Oregon, the rate to become effective May 22. It is estimated that the revised schedule will mean a saving of $410,000 to power consumers. It is stated that Yakima and Walla Walla districts will save $225,000 and Oregon users, $185,000.

EASTERN SHORE PUBLIC SERVICE CO. and its associated company, the Maryland Light & Power Co., have reached an agreement with the Maryland Public Service Commission under which the customers of these companies in the State of Maryland will receive rate reductions of $100,000 a year. Total reduction for the nine counties of the Eastern Shore will amount to $77,000, while in more thinly settled southern Maryland the saving will total $23,000. In a separate announcement, Lewis Payne, president of the Eastern Shore Public Service Co. of Maryland, said that still another reduction, amounting altogether to $32,000 was being extended voluntarily to customers of the company's Delaware affiliate. This will affect residents of Kent and Sussex counties, Delaware. The Delaware corporation, the Eastern Shore Public Service Co., is not under any form of state regulation, since Delaware has no utility commission. The new rate schedules are to go into effect for Maryland Light & Power Co. customers on all consumption registered after the May meter readings. On the Eastern Shore rate details remain to be worked out, so that the changes will be applicable only after the June meter readings.

CENTRAL ARIZONA LIGHT & POWER CO. has reduced its electric rates $90,000 on annual bills of consumers in Phoenix and other Salt River Valley communities. The new rates became effective May 1. Residential, commercial and industrial users were affected. The new rates were approved by the Arizona Corporation Commission after conferences with officials of the utility. In announcing the reduction, Amos A. Betts, chairman of the commission, said: "In view of existing war conditions and the uncertainty of the future with respect to rising costs of material and labor as well as future defense taxation, we are particularly pleased to announce a rate reduction at this time."

MISSOURI UTILITIES CO. has reduced its electric rate schedules for more than 30 southeast Missouri communities. The state Public Service Commission estimated the rate reduction would amount to $25,000 annually.

ILLINOIS COMMERCE COMMISSION has announced that rate changes effective during the month of April in the state of Illinois

by utility companies resulted in an estimated decrease of $31,272 in annual operating revenues. Rate reductions by electric utilities amounted to $38,907, but rate increases by telephone companies accounted for the $31,272 total for all utilities.

WESTERN COLORADO POWER CO. has cut its electric rates $600 annually.

MILTON (ORE.) City Council has announced a new schedule of reduced electric rates which will result in a total saving to the customers of the city plant of approximately $11,250.

RICHMONDVILLE, N. Y., has been authorized by the state Public Service Commission to put into effect revised rates which will result in annual savings of more than $2,000 to residential and commercial users of electricity. The new schedule went into effect May 1.

ELLENVILLE ELECTRIC CO. has been granted permission by the New York Public Service Commission to put into effect revised rates which will result in savings of $211 to industrial consumers in Ellenville and a portion of the town of Wawarsing, Ulster County. The change became effective May 15.

PUGET SOUND POWER & LIGHT CO. has announced a 20 per cent reduction in power rates in eastern Washington for irrigation pumping.

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Postpones Rate Hearing Pending Consolidation

Federal Power Commission has postponed until June 23 the public hearing previously scheduled to begin on April 21 concerning rates charged for natural gas sold by the Public Service Co. of Indiana to the Northern Indiana Power Co.

The Public Service Co. of Indiana, in an application for continuance filed with the commission, states that proposed consolidation of the two companies has been approved by the Public Service Commission of the State of Indiana and that consummation of the consolidation is expected as of June 1, 1941, if approved by the Securities and Exchange Commission.

•

Seeks to Export Energy

Public Service Co. of New Hampshire, Manchester, has applied to the Federal Power Commission for a Presidential permit authorizing the construction, operation, maintenance or connection at the international boundary of the United States and Canada of facilities for transmission of electric energy. The application is, in effect, for authority to continue the operation and maintenance of existing facilities for the exportation of energy into Canada. The company operates two short transmission lines extending across the international boundary into Hereford, Province of Quebec.

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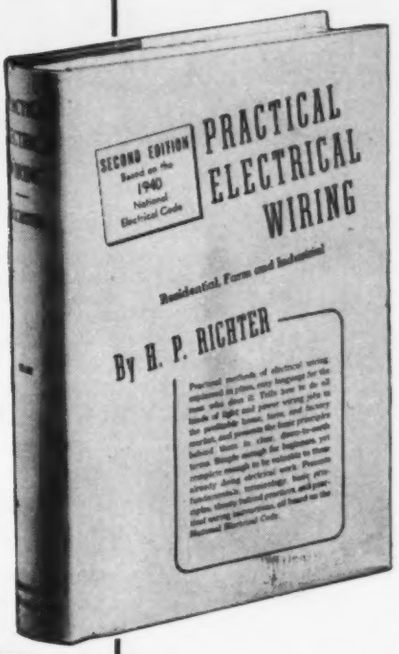
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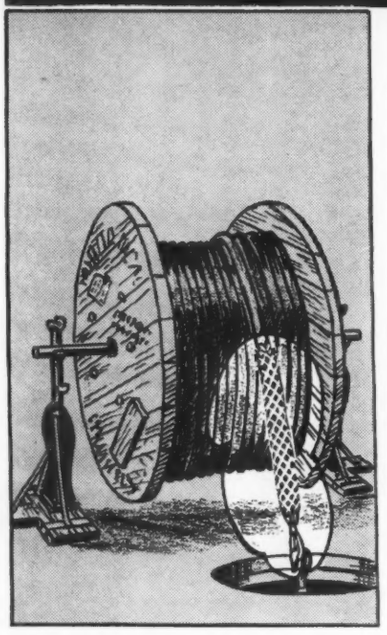

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Sales Opportunities

BAY CITY, MICH.—Consumers Power Co., Jackson, Mich., plans extensions in distribution lines in Bay City district, totaling close to eight miles. Work is scheduled to begin soon.

MORGANTOWN, W. VA.—Monongahela-West Penn Public Service Co., Fairmont, W. Va., is completing plans and surveys for new 132,000-volt transmission line from power plant at Rivesville, W. Va., to new ordnance mill of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., at Morgantown, where service will be furnished. A terminal power substation for step-down service will be located at mill site. Entire project will cost about $775,000. A certificate of necessity has been issued by Federal Government, providing for immediate construction. Another transmission line is planned to Fairmont from same generating station noted. This is part of 1941 expansion program of company.

BREMERTON, WASH.—Bureau of Yards and Docks, Navy Department, Washington, D. C., receives bids (no closing date stated) for two 1000-kw., and one 800-kw. motor-generator sets, complete with accessories, including switchboards and one 100-kw. dual drive, steam-electric exciter, for Puget Sound Navy Yard, Bremerton (Specifications 10425). Also, bids (no closing date stated) for equipment for an automatic protective system for boundary fence at same navy yard (Specifications 10427).

GEORGETOWN, S. C.—Southern Kraft Corp., Georgetown, plans installation of motors and controls, switchgear, transformers and accessories, duct lines, conveyors and other equipment in connection with expansion and improvements in local mill, used for production of corrugating board specialties, kraft paper products, etc. Large increased capacity will be arranged. Work is scheduled to begin soon. Cost estimated close to $2,000,000, including equipment. Main offices are at 220 East Forty-second Street, New York, N. Y. Company is affiliated with International Paper Co., last noted address.

ROCHESTER, N. Y.—Rochester Gas & Electric Corp. will begin work soon on superstructure for addition to steam-electric generating station for expansion in steam division, including installation of new high-pressure boiler and auxiliary equipment. This is part of 1941 extension program of company, previously announced.

LOUISVILLE, KY.—E. I. du Pont de Nemours & Co., Organic Chemicals Department, Rubber Chemicals Division, du Pont Building, Wilmington, Del., plans installation of transformers and accessories, motors and controls, switchgear, duct lines, fluorescent lighting system, inter-communication system, conveyors and other equipment in new mill at Louisville for production of Neoprene synthetic rubber. It will comprise several large one and multi-story production units, to be equipped for initial capacity of about 10,000 tons per annum. Cost estimated close to $12,000,000. Work is scheduled to begin soon.

SHEFFIELD, ALA.—City Council plans extensions in primary and secondary lines for expansion in rural electric system, totaling over 30 miles, with new lines to Mount Hester, Maud, Underwood Crossing, Moody Lane and neighboring points, where service will be furnished in future. Cost estimated about $60,000. Further expansion will be carried out at later date, comprising close to 20 miles of lines in other areas. Gordon Persons Co., 200 Montgomery Street, Montgomery, Ala., is engineer in charge of surveys.

BROOKLYN, N. Y.—Bureau of Yards and Docks, Navy Department, Washington, D. C., receives bids (no closing date stated) for drydock pumping equipment at Brooklyn navy yard, including removal and replacement of present main-dock pumping units, motor starters, control cabinets, switchgear, wiring system, motor-operated valves with controls, complete new lighting system for pump well, new controls for existing vacuum pump and sump pump motors, pump suction and discharge piping, etc. (Specifications 10106).

CHICAGO, ILL.—Commonwealth Edison Co. has taken out a permit for new addition, 26 x 31 feet, to power substation at 1700-14 West Carroll Avenue, and will proceed with erection at once. Equipment will be installed for increased capacity. H. V. Von Holst, 140 South Dearborn Street, is architect.

DUBUQUE, IOWA—Interstate Power Co., Dubuque, is arranging immediate call for bids for addition to local steam-electric generating station, 50 x 60 feet, and 65 feet high, for expansion in steam department, with installation to include new boiler unit and auxiliary equipment. Sargent & Lundy, Inc., 140 South Dearborn Street, Chicago, Ill., is consulting engineer.

READING, OHIO—City Council has plans under way for expansion and improvements in municipal steam-electric power plant, with installation of new 2500-kw. turbine-generator unit and accessory equipment. Proposed to remodel part of present station. Estimates of cost are being made. Carl J. Kiefer & Associates, Inc., Schmidt Building, Cincinnati, Ohio, is consulting engineer.

DES MOINES, IOWA—Marquette Cement Manufacturing Co., 140 South Dearborn Street, Chicago, Ill., plans installation of motors and controls, transformers and accessories, switchgear, duct lines, industrial lighting facilities, conveyors, loaders and other equipment in new mill at Des Moines, consisting of main one and multi-story production unit, about 85 x 450 feet, and several smaller structures. Cost reported over $1,000,000.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until June 2 for line hardware for extension in switchyard of Southern California Edison Co. at Boulder power plant, Boulder Canyon project, Arizona-California-Nevada (Specifications 1498-D).

LOS ANGELES, CALIF.—Bureau of Power and Light, 207 South Broadway, is completing plans for new power substation on Venice Boulevard, to be known as Receiving Station "D", and will begin construction soon. Erection will be carried out by construction department of Bureau, with own forces. Cost is estimated at $1,366,000, of which about $1,150,000 will be used for equipment and remainder for building.

PHILADELPHIA, PA.—Bureau of Yards and Docks, Navy Department, Washington, D. C., receives bids (no closing date stated) for condenser, air ejectors and condensate pumps for installation in navy yard, Philadelphia (Specifications 10401).

BIRMINGHAM, ALA.—Birmingham Terminal Company, 501 North Twenty-sixth Street, plans new electric interlocking and signal plant for service for group of six railroads using terminal. Cost estimated about $250,000. Work is scheduled to begin early in fall. Specifications for equipment will be determined soon.

REA Allots $70,000 for Mobile Units

Rural Electrification Administrator Harry Slattery has announced allotments totaling $70,000 for four mobile generating units in Idaho and Missouri.

To the Long Valley Power Co-operative, Inc., Donnelly, Idaho, E. A. Tull, superintendent, $35,000 was allotted for the installation of two mobile generating units. To the Crawford Electric Co-operative, Inc., Bourbon, Mo., R. L. Mook, president, was allotted $35,000 for the installation of two mobile generating units.

These mobile generating units will serve the systems for a short period only, it is expected, while present power problems are being adjusted. It is anticipated that these units will be transferred to a power reserve co-operative, so that the entire amortization of the mobile plants will not be borne by these co-operatives.

An allotment of $50,000 was also made to the Vermont Electric Co-operative, Eden Mills, Harry D. Bowman, superintendent, for building 45 miles of line to serve 145 members in Chittenden, Washington and Lamoille counties.

During the last week in April allotments totaling $427,000 for rural electrification were made in three states. To the Dixie Electric Membership Corp., Baton Rouge, La., E. B. Thompson, manager, an allotment of $27,000 was made to complete a section of the system. To the Border Counties Power Co-operative, Baudette, Minn., Frank H. Tim, correspondent, an allotment was made amounting to $50,000 for constructing a generating plant and installing one 250 kw. unit initially. To the Cumberland Electric Membership Corp., Clarksville, Tenn., M. C. Northington, supt., an allotment of $350,000 for the acquisition and construction of 425 miles of line to serve 2,629 members in Sumners, Robertson and Stewart counties, was announced.

Among the construction contracts approved between March 22 and April 24 are the following:

ARKANSAS—Southwest Arkansas Electric Co-operative Corp., Texarkana, Calvin M. Hervey, Jr., manager, and Ray W. Chanaberry, Louisville, Ky., engineer, contract to Stuart C. Irby, Jackson, Miss., 125 miles of line, 204 members; bid, $63,173.

COLORADO—Intermountain Rural Electric Assn., Bailey, J. R. Maile, supt., and Glenn R. Fickel, Denver, Colo., engineer, contract to E. A. Reither, Aitkin, Minn., 219 miles of line, 415 members; bid, $164,543.

FLORIDA—Choctawhatchee Electric Co-operative, Inc., Crestview, J. C. Green, supt., and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to H. B. Nelson Construction Co., 207 Red Rock Bldg., Atlanta, Ga., 356 miles of line, 760 members; bid, $190,224.

GEORGIA—Upson County Electric Membership Corp., Thomaston, Ga., T. S. Jackson, manager, and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to Roy Richards, Box 88, Carrollton, Ga., 87 miles of line, 245 members; bid, $53,290.

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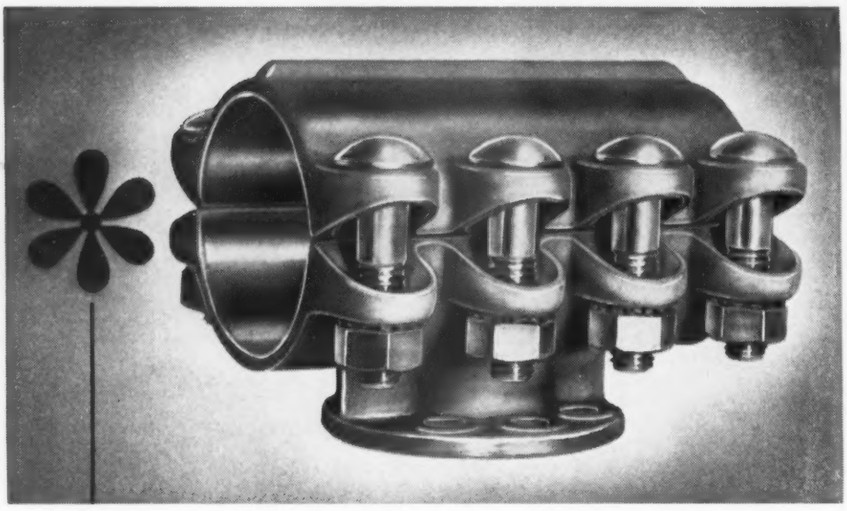

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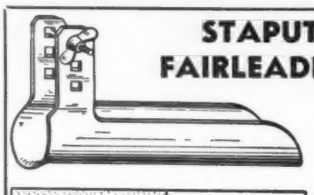

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IDAHO—Long Valley Power Co-operative, Inc., Donelly, E. A. Tull, supt., and Edelblute & Mackenzie, Box 7, Colville, Wash., engineer, contract to C-L Electric Co., Pocatello, 118 miles of line, 241 members; bid, $74,974.

ILLINOIS—Wayne-White Counties Electric Co-operative, Fairfield, F. A. Tannahill, acting superintendent and Rural Line Engineers, Clayton, Mo., engineer, contract to A. A. Electric Co., Cicero, Ill., 344 miles of line, 834 members; bid, $263,793.

KANSAS — Jewell-Mitchell Co-operative Electric Co., Inc., Ionia, Wesley W. Schutz, supt. and Paulette & Wilson, Topeka, engineer, contract to Elkhorn Construction Co., Norfolk, Neb. 217 miles of line, 284 members; bid, $140,734.

KENTUCKY—Cumberland Valley Rural Electric Co-operative Corp., Pineville, James C. Bright, president, and Ray W. Chanaberry, Louisville, engineer, contract to Codell Construction Co., Inc., Winchester, Ky., 267 miles of line, 735 members; bid, $195,382.

LOUISIANA—Pointe Coupee Electric Membership Corp., New Roads, Alfred A. Robinson, acting superintendent, and H. B. Gieb and Associates, Dallas, Tex., engineer, contract to Stuart C. Irby Co., Jackson, Miss., 34 miles of line, 134 members; bid, $19,039.

MINNESOTA—North Star Electric Co-operative, Inc., Baudette, Clarence Peterson, Co-ordinator, and General Engineering Corp., Minneapolis, engineer, contract to E. W. Wylie, Inc., St. Paul, Minn., 234 miles of line, 439 members; bid, $147,401.

MISSISSIPPI—Magnolia Electric Power Assn., P. O. Box 979, McComb, G. H. Alford, supt., and Bowman and Bowman, Greenwood, Miss., engineer, contract to Stuart G. Irby & Co., Jackson, Miss., 202 miles of line, 554 members; bid, $112,935.

MISSOURI—Crawford Electric Co-operative, Inc., Bourbon, R. L. Mook, president, and Midwestern Engineering & Construction Co., Tulsa, Okla., engineer, contract to Allied Contracting Co., Eau Claire, Wis., 325 miles of line, 711 members; bid, $225,438.

OHIO — Guernsey-Muskingum Electric Co-operative, Inc., New Concord, H. B. Smith, supt., and Putnam and Woolpert, Dayton, Ohio, engineer, contract to D & W Construction Co., Columbus, 168 miles of line, 388 members; bid, $120,324.

OKLAHOMA—Norhtwestern Electric Co-operative, Inc., Woodward, Wilfred Johns, president, and C. H. Guernsey & Co., Cherokee, engineer, contract to Walco Engineering & Construction. Co., Tulsa, 347 miles of line, 487 members; bid, $180,243.

SOUTH CAROLINA—Blue Ridge Electric Co-operative, Inc., Pickens, A. J. Hurt, supt., and Hammond & Long, Columbia, S. C., engineer, contract to Day & Zimmermann, Inc., Philadelphia, 535 miles of line, 1456 members; bid, $311,105.

TENNESSEE—Sequatchie Valley Electric Co-operative, South Pittsburg, Tenn., R. L. Lodge, president, and Francis and Haley, Birmingham, Ala., engineer, contract to Oman Construction Co., Nashville, 190 miles of line, 698 members; bid, $139,891.

VIRGINIA—Virginia Electric Co-operative, Bowling Green, W. H. Brown, supt., and C. W. Hylton, Bowling Green, engineer, contract to G. E. Barron, Blackstone, Va., 164 miles of line, 450 members; bid, $110,010.

WASHINGTON—Inland Empire Rural Electrification, Inc., Spokane, Victor P. Campbell, manager and Charles H. Shouse, Spokane, engineer, contract to Tri-State Construction Co., Portland, Ore., 302 miles of line, 371 members; bid, $195,653.

Eternal Vigilance Price of Distribution Economy

[*Continued from page 48*]

our passenger cars and trucks. Of the cars that were traded in during the past two years the average use was 86,000 miles, and many vehicles operated more than 100,000 miles. We use depreciation rates which charge off the cost of our cars in about 60,000 miles, and the approximate 26,000 miles we average beyond this 60,000, when no more depreciation is charged, cost less per mile than the first 60,000 miles with depreciation. We maintain a central shop where all work is done on cars within the immediate vicinity of the shop, and cars from distant points are sent to the central shop for major repairs or general overhauling.

Transformer Losses

Our distribution transformer losses have been gradually decreasing, and for 1940 the total loss from all causes was 0.88 per cent. The loss from lightning was 0.26 per cent, although during this year we had about the usual amount of lightning storms. We have 14,000 transformers, the average size being 7.3 kw., and some of them are more than thirty years old. As stated previously, we install lightning protection with each transformer, grounding together transformer case, arrester and secondary.

A recent analysis of instrument transformer failures on our primary metering equipment revealed a far less satisfactory situation. Failures on this equipment amounted to 5 per cent. Failures on the 6,900-volt class were more than 8 per cent, and in the 2,300-volt class more than 4 per cent, and they were about equally divided between current and potential transformers. In the future we expect to use instrument transformers with a higher insulation level.

While studying the subject of instrument transformers, we were rather shocked to note that gum-filled 6,900-volt potential transformers without any accessories cost just about twice as much as 3-kva. distribution transformers of the same voltage and with a higher insulation value.

Tree Trimming

Like every one else, we have given this matter of tree trimming a lot of study, particularly as to whether we should do this work with our own men or have it done by outside tree trimming companies. Our present policy is to use our own men in districts where there is enough work to keep one tree trimming crew busy throughout the year, working from the district headquarters. This is the case in only two of our eleven districts. For the other nine districts we have two outside crews which move about from place to place as directed by us. These men pay their own board and move about so that they are always near their work, and thus they do this work more economically than our own men, since it is our custom to pay living expenses of our men when away from their home base.

There have been instances where the outside professional tree trimmers could get permission to trim trees which we had not been able to get previously. However, as our men become more proficient and learn to look after the appearance and life of the tree, as well as get line clearance, the public gradually gains as much confidence in us as in professionals.

Live-Line Work

We have been doing live-line work with rubber gloves on 6,900-volt lines for several years and consider the practice satisfactory. For 12,000-volt (6,900-volt-to-ground) lines, we have been making increasing use of insulated platforms rather than live-line tools. We first used these platforms* on a job of replacing 1,500 insulators on a 13,200-volt line which was being changed to 33,000 volts. The men to be used on this job were given some preliminary training on a model of the pole top which they were to work, and the job was done economically and with no accidents of any kind.

Right-of-Way Clearing

On right-of-way clearing our present policy is to clear the entire width every three years in sections where the growth is rapid and every six years in sections where the growth is slow, and in the intervening years to trim a path about 15 ft. wide to facilitate patrolling and maintenance work. We have never found any practical way to kill off growth, but fortunately it seems to decrease a little

* See "Uses Rubber Protective Equipment on 13.2-kv.", *Electrical World*, August 10, 1940, page 49.

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Modern STATES Tables are better equipped, safer, handier — they meet the demand of the times:—

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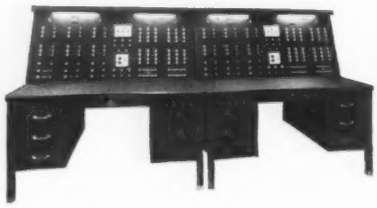
2. All switches are dead front
3. Insulation break down test equipment included
4. Inclined panel aids visibility and accessibility
5. All bus wiring enclosed



Tear off and Mail today

To the STATES COMPANY
Hartford, Conn.

Send full information on STATES Test Tables.

Name ..... Title.....

Company .....

City ..... State.....

with each cutting, and in the course of time the cost of clearing any right-of-way should decrease materially.

The Scrap Pile

There is a continual puzzle whether used non-standard materials which are still in good condition, and pieces of timber, structural steel, etc., should be placed on the scrap pile, or added to the collection of miscellaneous retired misfits which is found around every district. One is inclined to cling to as much of this stuff as he can find room for, because he remembers he wanted to use something recently soon after the junk man had taken it away. If storage space is available it pays to keep a certain amount of such non-standard materials provided the people who lay out work keep them in mind and try to use them.

Cooking Program Yields 2,000 Kw. Annually

[*Continued from page 55*]

to the successful prosecution of this highly specialized business.

Although December, 1938, brought organization changes to those engaged in commercial cooking with the Commonwealth Edison Company, there were few changes in policy. Direct selling for the purpose of market development and dealer stimulation continues in electrical cooking devices as it does in most all electrical equipment. The long-ago-discovered success formula of free demonstrations of counter-cooking devices to prospective users in their own places of business is still carried forward on an expanding scale. The ratio of purchase to demonstration is high, and frequently where a sale for the particular device shown is not consummated interest in another piece of equipment is uncovered and developed. Or again our demonstration occasionally results in sale by a dealer who is unable to demonstrate. This result is quite as satisfactory as though we had sold the equipment.

Most recent development in the free demonstration program is the trial installation of a small electric bake oven. After a thorough check of the premises where a permanent installation is in prospect a trial oven is offered for a one-month period. If the offer is accepted the trial oven is delivered, set up and wired in through separate meters. From the meter readings the costs are calculated on the particular rate that applies. In this way any operating cost misconception the prospect might have is corrected at the outset. This development is so new that evidence as to its merit is not yet conclusive. However, it does show promise.

Customer Data

Complete knowledge of operating costs have been found of great value to salesmen operating in the commercial cooking field in proving the economy of operation to prospects. In order to keep such information vital, job records are kept and studied. This involves the tabulation of equipment sold, its load and a review of the particular customer's billing before and after installation. Occasionally test meters are set on particular devices in users' establishments, in order to determine the maximum demand, its time of occurrence and the energy used.

Soon after the formation of the commercial cooking division these operating cost records proved of value in another direction, for they seemed to indicate that the company's retail commercial rates did not lend themselves satisfactorily to the electric cooking load. This evidence was submitted to the rate makers, and, after careful field tests and studies, a promotional alternating-current rate was put into effect. Soon thereafter an off-peak rider, applying to a.c. only, was developed and established to encourage the use of electric ovens on a separately controlled clock meter.

Another deterrent to this class of business seemed to be the high cost of installation as compared with equipment using fuel other than electricity. To offset this apparent handicap a restricted schedule of wiring-in allowances was initiated. Allowance payment was made to the customer provided he was served on our retail commercial rate, and the amount was predicated on the connected load of the device sold him. This allowance materially increased the amount of business secured.

Following the formation of the separate division in 1938, the Commonwealth Edison Company has advertised the electric cooking idea more extensively to its customers. Newspaper user copy is sometimes employed advertising the fact that

some well-known food purveyor has gone all electric. For example, this type of advertisement appeared in the metropolitan dailies, the community and foreign language papers when the Forum Cafeteria, a well-known national chain, opened a branch in Chicago in 1939 with a complete electric kitchen having a connected cooking load of 306 kw. Advertising space in trade papers having local circulation is also used. Direct mail folders are employed extensively, and larger, more expensive brochures on the subject of electric cooking are delivered personally by the sales force. The *Commercial* and *Industrial News*, house organs promoting electrical usage among all commercial and industrial customers and mailed on schedule each two months, both carry considerable copy concerning the electrical cooking idea. These house organs have proved so effective that our present plans contemplate a separate *Electric Restaurant News*, which will be mailed six times yearly to our food preparation group of customers. Advertising is further rounded out by displays with trained men in attendance at hotel, chefs' and bakers' and other related expositions from time to time each year.

We in Chicago with the Commonwealth Edison Company confidently expect this acceleration to continue, for we feel that we now have the nucleus of a snowball in motion with Field's and the Belden Stratford Hotel on the repeat list, with new complete installations in such large and popular organizations as Forum Cafeteria, the Salt Box, the Hitching Post, Wimpy's Grill, the Mirsky Drug Company, and others—a snowball that will roll on and attach to itself an ever-increasing number of customers committed to the idea of electricity as a fuel for cooking.

•

Board May Extend Power

A bill introduced into the 1941 session of the New Brunswick Legislature at Fredericton, N. B., as a government measure confers on the New Brunswick Electric Power Commission, a subsidiary of the provincial government, full control over all electric power plants and distribution systems in New Brunswick. Hitherto, the commission control has been limited to province-owned-and-operated plants and systems.

Engineers Prepare for Emergency Conditions

[*Continued from page 59*]

for all voltages 15 kv. and less, in sizes 37½ to 50 kva., will be for direct pole mounting, but crossarm hanging devices can be used by those who prefer it.

Lively discussion of cost and design aspects of steel inclosures for station switchgear, led by E. B. Shew, Philadelphia Electric Company, at the open session of the electrical equipment committee indicated widespread acceptance of steel switchgear cubicles but differences on cost and design between manufacturers and users. Cost of metal-clad equipment was felt to be out of proportion to what it should be for factory fabricated switchgear housings. Several engineers reportedly have found it economical to design and assemble their own switchgear housings, using relays and auxiliary equipment to suit their own preferences. Opinion was expressed that clearances and temperature rise considerations in factory-assembled 12-15-kv. equipment should be given more careful study by manufacturers to bring it into agreement with utility requirements.

Rectifiers

Switching problems involved in limiting backfire current of mercury-arc rectifiers are receiving considerable attention in the aluminum industry, D. I. Bohn, Aluminum Co. of America, reported in discussing power supply aspects of the aluminum industry. High-speed breakers are being used by the company in rectifier cathode circuits to interrupt backfires in ½-cycle time. These are backed up by 13.2-kv. a.c. breakers of 70,000 kva. rating which remove the rectifier transformer from the 13.2-kv. bus to prevent development of a.c. short circuits following cathode interruption. Recently, high-speed 1,600-amp., six-pole d.c. "anode" breakers have been used between transformer and rectifier in conjunction with cathode breakers. This leaves the transformer energized on backfire and makes for more rapid service restoration.

Electrified railroads are an important potential load for utilities, but high rates, varying from ¾ to 1 cent per kilowatt-hour, are a major deterrent, H. F. Brown, New York,

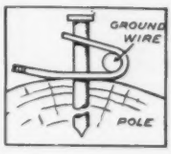
caused 75% of bad INDUCTIVE ARCS

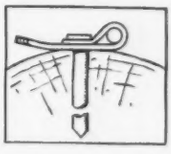
and these

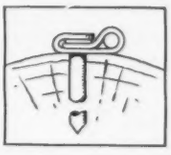
KEARNEY

GROUND WIRE CLIPS

stopped troublesome Radio Interference



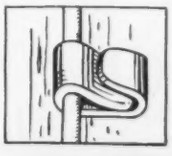




GROUND WIRES on poles were checked. Everywhere, whether from expansion or contraction, staples had worked loose and out of contact with the ground wire.

Here was trouble. Inductive arcs—radio interference.

But this trouble was eliminated. Kearney Ground Wire Clips were used, with long nails driven into poles. These stay put and keep good, quiet contact between clip and ground wire. (Note illustration).



ALSO GROUND CLAMPS

And Kearney standard and Heavy Duty Ground Clamps give better, trouble-free grounds.

Ask a Kearney Representative to show you samples . . . or write — James R. Kearney Corporation, 4236 Clayton Ave., St. Louis, Mo. — Canadian Plant, Toronto, Canada.

JAMES R. KEARNEY

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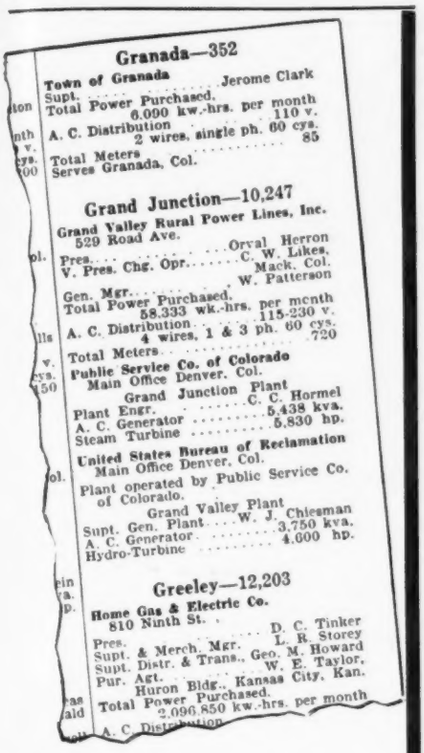
ROBERT E. FOLEY CONSTRUCTION CORPORATION
Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines
48 Griswold St. Binghamton, N. Y.

ARTHUR L. MULLERGREN
Public Utilities Consultant
Management
Fairfax Bldg. Kansas City, Mo.

THE J. G. WHITE ENGINEERING CORPORATION
Engineers — Constructors
New York, N. Y.



Granada—352
Town of Granada
Supt. ..... Jerome Clark
Total Power Purchased.
6,000 kw.-hrs. per month
A. C. Distribution ..... 110 v.
2 wires, single ph. 60 cys.
Total Meters 85
Serves Granada, Col.

Grand Junction—10,247
Grand Valley Rural Power Lines, Inc.
529 Road Ave.
Pres. ..... Orval Herron
V. Pres. Chg. Opr. ..... C. W. Likes,
Mack, Col.
Gen. Mgr. ..... W. Patterson
Total Power Purchased.
58,333 wk.-hrs. per month
A. C. Distribution ..... 115-230 v.
4 wires, 1 & 3 ph. 60 cys.
Total Meters 720
Public Service Co. of Colorado
Main Office Denver, Col.
Grand Junction Plant
Plant Engr. ..... C. C. Hormel
A. C. Generator ..... 5,438 kva.
Steam Turbine ..... 5,830 hp.
United States Bureau of Reclamation
Main Office Denver, Col.
Plant operated by Public Service Co.
of Colorado.
Grand Valley Plant
Supt. Gen. Plant ..... W. J. Chiesman
A. C. Generator ..... 3,750 kva.
Hydro-Turbine ..... 4,600 hp.

Greeley—12,203
Home Gas & Electric Co.
810 Ninth St.
Pres. ..... D. C. Tinker
Supt. & Merch. Mgr. ..... L. R. Storey
Supt. Distr. & Trans., Geo. M. Howard
Pur. Agt. ..... W. E. Taylor,
Huron Bldg., Kansas City, Kan.
Total Power Purchased.
2,096,850 kw.-hrs. per month
A. C. Distribution

THIS just gives you a quick idea of the completeness of the listings in the 1940 Central Station Directory. Check it over and see what **more** information you could want to make up market analyses . . . to help salesmen or representatives see the **right** person . . . or for quick reference for that particular bit of information you need. The Central Station Directory is a veritable encyclopedia, one that will save you dollars, cents and time.

●

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Catalog and Directory Division
330 West 42nd St., New York, N. Y.

Gentlemen: You may mail us ..... copies of the 1940 McGRAW CENTRAL STATION DIRECTORY. Deliver to the following address and bill us at the rate of $25.00 per copy. (10% discount on 5 or more copies.

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(Address) .....

.....

(Signed) .....
NAME TITLE

New Haven & Hartford R.R., told overhead transmission group of the T & D committee. Greatest railroad demand occurs during off-peak early morning hours, when utilities could well afford to give service at a lower rate, he pointed out. Low electric vs. Diesel maintenance costs on roads with high traffic density are deciding factors favoring electrification in spite of the higher per kilowatt cost of electrification, he stated. With electric capacity at $110 per kilowatt and Diesel cost $85 per horsepower, the 7-cent-per-horsepower maintenance cost for electric operation favors electrification over Diesel-electric operations.

In contrast to the New Haven, which generates 60 per cent of its power needs, J. M. Trissal of the Illinois Central stated that all power for his line is purchased from Commonwealth Edison Company. Smoke corrosion conditions on the I.C. has recently required replacement of 5,000 insulators on which glaze had been eaten away, Trissal reported.

Steps taken by Duquesne Light Company to lightning-proof two portions (15.1 miles and 9.1 miles) of the 120-mile double-circuit steel tower transmission ring around Pittsburgh were exhaustively analyzed by W. R. Metzger and E. R. Whitehead. This line will be discussed in an early issue of ELECTRICAL WORLD.

LETTER TO THE EDITOR

Generator Protection

To the editor of ELECTRICAL WORLD:

I have just received a copy of the May 3 issue of ELECTRICAL WORLD, in which my article entitled "Carbon Dioxide Safeguards Hydro Generators" has been published. The arrangement of this article appears to be satisfactory, but we wish to call your attention to an error appearing in the title of the illustration at the center of page 55. The first line of this title reads "Seventy 50-ton carbon dioxide cylinders—" but the word "ton" should be replaced by "pound" . . . .

J. B. CUTLER, *Mechanical Engineer Safe Harbor Water Power Corp., Baltimore, Md.*

This error was a pretty obvious and glaring one. The editors are glad to have it called to their attention.

This sign becomes effective only when property is protected by a Stewart Non-Climable Chain Link Wire Fence. Stewart Fences assure continuous, dependable protection and exclusion of enemy agents. Next month may be too late—you need Stewart protection NOW! Send for Catalog No. 79. Sales and Erection offices in principal cities.

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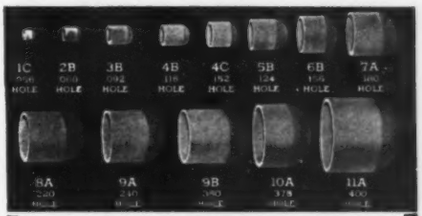
0-500 lbs. to 0-15000 lbs.

$50.00 to $117.50 *including carrying case and shackles*

W. C. DILLON & COMPANY
5410 W. Harrison St. Chicago, Ill.



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Use **Lavolain** ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U. S. A. Quality beads at low cost. Quickly applied. Flexible. Beads shown above are approximately half actual size. Ask for price list and samples.

STAR PORCELAIN CO.
TRENTON, N. J.

ENGINEERS

ELECTRICAL

Positions open for first-class electrical designers and draftsmen; experienced in industrial lighting and power distribution, for industrial plant construction.

Good opportunity for qualified men. Give full information first letter and hourly rate desired. Address

P-902, Electrical World,
520 No. Michigan Ave., Chicago, Ill.

POSITIONS VACANT

GRADUATE ELECTRICAL ENGINEERS or experienced electrical draftsmen qualified to design electrical stations by Midwest Public Utility Engineering Organization wanted. Application should include outline of training and experience, and indicate salary desired. P-904, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

DRAFTSMEN: Electrical designers experienced power plant and substation design. Location New York City. In reply state age, salary desired and experience. P-907, Electrical World, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 31 years' recognized standing and reputation carries on preliminary negotiations for positions of the calibre indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

Executives and Technical Men. Qualified candidate desiring $2,500 to $20,000 position may contact employers through our confidential services, established 25 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

(See also "Selling Opportunity Wanted")

ELECTRICAL ENGINEER—15 years progressing experience. Watt hour meters relays voltage regulators—automatic equipment, breakers, synchronous condensers, sub-stations; load-voltage problems. Desires connection with utility or manufacturer. PW-903, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

SUPERINTENDENT municipal or rural electric system steam and diesel experience. PW-905, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

PURCHASING AGENT. Twenty years experience Electric Utility and Electrical Wholesaling; organization, office management, inventory and stock control. Some sales experience. Employed at present but desire change. Qualification record on request. PW-906, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER, professional license, 20 years experience supervising electrical layouts and designs for industrial power plants and distribution systems, also experienced in steam plant design. Available now, prefer locate vicinity New York City. W. F. Demmerle, 84 Bay Driveway, Manhasset, N. Y.

SELLING OPPORTUNITY WANTED

MANUFACTURERS AGENT established 15 years in Southern California calling on utilities, aircraft and general industrial — can handle an additional line. RA-901, Electrical World, 68 Post Street, San Francisco, Cal.

Additional Electrical Line

Wanted by newly established manufacturers' representative which can be sold to manufacturers or Utilities for Connecticut or New England. Sixteen years' experience in the electrical industry. Write

Box 1393,
Hartford, Connecticut

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CABLE-SPLICERS WIPING CLOTHS. Formed-flexible finishing cloths (Patented); Flat finishing cloths; Catch cloths; Crotch cloths and Up-right joint catch cloths. Made of world-prize Herringbone Ticking or imported English Moleskin. Write us for literature and prices. Geo. E. Williams, Mfr., 3035 Aldrich Avenue, Minneapolis, Minn.

FREE BULLETIN

Classified April Stock Summary power, electrical and construction equipment. 32 pages, 5½ x 8¼. Write T. K. White, Apparatus Exchange, Ebasco Services, Inc., 2 Rector St., N. Y. C.

FOR SALE

Bids: June 10 (74)

Sale of Equipment

CITY OF MONROE
COMMISSION GOVERNMENT
Monroe, La., April 30th, 1941.

Sealed bids will be received by the City Council of the City of Monroe, Louisiana, up to 10 o'clock A.M., June 10th, 1941, for the sale of the following equipment:

1—General Electric Rotary Converter, 300-KW-3 phase, 60 cycle 500 Amps, 600 volts, speed 1200 R.P.M., with 2300 volt A.C. Circuit breaker, panel, ammeters, watt meters, starting switch and 3 transformers from 2300 volts to 445 volts.

1—General Electric Rotary Converter, 200-KW-3 phase, 60 cycle 334 Amps, 600 volts, speed 1200 R.P.M., with 2300 volt A.C. Circuit breaker, panel, ammeters, starting switch and 2 transformers of ample capacity for 200 KW-2300 volts to 370 volts.

1—Ingersoll Rand, class F.R.1 vacuum pump, size of steam cylinder 10" by 10", air cylinder 26" x 10," 235 R.P.M. 1432 Cu. Ft. per min. 28" vacuum, 150 lbs. steam pressure, 100 degrees superheat.

1—Manistee Pump, 12" suction, 12" discharge, 1750 R.P.M., 3000 G.P.M., 100 ft. head, direct connected to 125 H.P. 2300 volt, 3 phase, 60 cycle General Electric Induction Motor with starter complete.

All above equipment in good condition.

All bids may be addressed to P. A. Poag, Secretary-Treasurer and filed in his office. The City of Monroe reserves the right to reject any and all bids.

P. A. POAG, Secy.-Treas.

OFFICIAL PROPOSAL

Bids: June 2 (75)

Substation and other work

GRAND RIVER DAM AUTHORITY
GRAND RIVER PROJECT—PENSACOLA DAM, CONTRACT 13-H—TULSA SUBSTATION AND OTHER WORK
1941

Sealed bids will be opened by the Board of Directors of the Grand River Dam Authority in Vinita, Oklahoma, on the second day of June, 1941, at 10:00 o'clock A.M. for

Contract 13-H—the building of substations and other work as follows:

Section I—The Tulsa Substation, a 115-kv-69-kv-13.8-kv substation; the furnishing of all equipment except a 10,000-kva and an 8,000-kva power transformer and two (2) 69-kv oil circuit breakers furnished under Contract 13-G; the installation of all equipment, grading, excavation, fill, building of all steel and concrete work, reinforced concrete building, roadway, sidewalks, woven-wire fence, and concrete culvert;

Section II—The Markham Ferry Switching Station, including the removal of present equipment and the re-use of a portion of this equipment, the furnishing of all other equipment except a 1200-kva power transformer and a 115-kv oil circuit breaker furnished under Contract 13-G, the installation of all equipment, grading, excavation, fill, surfacing, and the building of all steel and concrete work, a reinforced concrete building, a roadway, and woven-wire fence;

Section III—At the Pensacola Switchyard the installation of a 1200-kva power transformer to be furnished under Contract 13-G, the furnishing of all auxiliary equipment and structures, and the installation of a carrier communication terminal.

Bidders shall bid on all sections and all items; and the work, if awarded, will be awarded as one contract for all the work herein included.

Bids may be filed with the General Manager of the Authority at his office in the

OFFICIAL PROPOSAL

City Hall, Vinita, Oklahoma, up to 10:00 o'clock A.M. of said day, at which time they will be opened and publicly read at a meeting of the Board of Directors. Any bid received after the closing time (10:00 o'clock A.M.) will be returned unopened.

The Plans and other Contract Documents are on file and can be seen at the Office of the General Manager of the Authority, City Hall, Vinita, Oklahoma, and they can be obtained from the Office of Holway and Neuffer, Engineers, 302 East 18th Street, Tulsa, Oklahoma, or Vinita, Oklahoma, on deposit of $25.00 of which amount $12.50 will be refunded upon return of plans and specifications in good condition within ten days after the award of the contract. No refund will be made after that date. The total amount of the deposit will be refunded to all bidders. All checks for these deposits shall be made out to Holway and Neuffer.

Each proposal must be accompanied by a certified or cashier's check on any solvent bank or trust company, payable without reserve to the Grand River Dam Authority, in an amount not less than five per cent (5%) of the total amount of the bid. If bids are held more than ten days any bidder may substitute a satisfactory Bidder's Bond for his check in the same amount, and thereupon his check will be returned to him. Checks or bid bonds of the three low bidders will be retained until approval of contract and execution of satisfactory bond by the successful bidder, or until other disposition of the bids is made.

The bonds required will be a performance bond for the faithful performance of the work and a statutory bond for the protection of laborers and materialmen, both in the full amount of the contract.

All bids must be made on the proposal forms furnished by the Authority and must be in accordance with the "Requirements for Bidding and Instructions to Bidders."

No bid may be withdrawn for at least sixty (60) days after the scheduled closing time for receipt of bids.

If awarded, the whole work under this contract will be awarded as one contract to the lowest responsible bidder.

All work herein advertised is to be paid for by voucher on estimates furnished by the Engineers.

Attention of the bidders is called to the Wage Scale as determined by the Authority and appearing in the "Construction Terms and Conditions."

The Authority will request every bidder, before his bid is considered for award, to file a statement of facts as to his previous experience in performing similar work of comparable magnitude, of his business and technical organization, and financial resources and plant available and to be used in performing the contemplated work. Each bidder must have such information, together with a recent financial statement, available at Vinita, Oklahoma, the day on which bids are to be received.

The Board of Directors reserves the right to reject any or all bids and to waive any informality in any bid.

Dated this 6th day of May, 1941.

GRAND RIVER DAM AUTHORITY,
By: RAY McNAUGHTON,
Chairman, Board of Directors.

Notice to Advertisers

Because of the Holiday, Memorial Day, May 30th the "Searchlight" pages of the

May 31st issue of

ELECTRICAL WORLD

close for press earlier than the usual closing time

The cooperation of advertisers is solicited in forwarding new copy, or changes of copy, to reach us accordingly.

FINAL CLOSING TIME
Display and Undisplayed Ads:
Friday, May 23rd

Industrial Property For Sale—See page 121